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MANAGING THE ENVIRONMENT

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RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, Environmental Protection Agency, have been grouped into five series. These five broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The five series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies

This report has been assigned to the SOCIOECONOMIC ENVIRONMENTAL STUDIES series. This series includes research on environmental management, comprehensive planning and forecasting and analysis methodologies. Included are tools for determining varying impacts of alternative policies, analyses of environmental planning techniques at the regional, state and local levels, and approaches to measuring environmental quality perceptions. Such topics as urban form, industrial mix, growth policies, control and organizational structure are discussed in terms of optimal environmental performance. These interdisciplinary studies and systems analyses are presented in forms varying from quantitative relational analyses to management and policy-oriented reports.

EPA REVIEW NOTICE

This report has been reviewed by the Office of Research and Development, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

abstract

This report on *Managing the Environment* grows out of a concern that a significant proportion of today's environmental problems are aggravated by a lack of effective environmental management techniques. The complexity of environmental issues and trade-offs involved in achieving environmental quality necessitate an understanding of the various perspectives on the environment held by government, industry, business, economists, ecologists and the citizenry. This report includes examinations from each of these viewpoints and discusses techniques for citizen participation, management information systems, organizational structures, special regulatory procedures and controls, legal actions and other methods for improving the management of the environment. Contained in this report are papers prepared by 40 different authors covering the full range of environmental management issues.

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The texts for the chapters were written by the following: Chapter 1 (Prologue)—Peter Nobert, Administrative Assistant for County Supervisor, Fairfax County, Virginia; Chapter II (The Environment as a Policy Issue)—Mary Ann Allard; Chapter III (Organizing for Environmental Management)—Steven Carter; Chapter IV (Citizen Participation in Environmental Management)—Joan Werner; Chapter V (Strategies for Managing the Environment)—Lyle J. Sumek, Professor of Public Administration, University of Colorado; Chapter VI (Environmental Management Information Systems) and design/editing—Richard M. Laska and John Gerba, Washington Environmental Research Center, and Chapter VII (Intergovernmental Relations)—Project Staff.

conclusions

While the range of issues covered in this report is vast, certain general conclusions can be drawn. First, the shortcomings of present environmental management techniques are widely recognized by decision-makers at all relevant levels of authority. Second, while sophisticated environmental concepts such as carrying capacity and variable standards are widely discussed by environmental analysts, the managers at the local level encounter overwhelming problems in translating some of these concepts into operational programs. Third, the successful managerial techniques developed with much difficulty by some communities are not communicated effectively to others who might profitably employ these techniques.

recommendations

Among the recommendations presented by the papers in this report are: First, more attention should be placed on the human aspects of environmental problems—the managerial interactions, opposing pressures and decision processes. Second, many local organizations feel buffeted by a multitude of environmental mandates without being provided with the associated managerial and technical assistance necessary to carry out these mandates. Third, sophisticated tools are being developed which may be of great help to the environmental manager, but these tools must be molded into a more easily transferable form in order to be effective.

introduction

Increasing attention has been focused on the environment as a public policy issue. In addressing that issue, public officials are faced with the question: how can government be more effective in managing the environment? For many years, federal, state and local governments have reorganized themselves and used various management techniques for addressing environmental problems. Since 1969, however, dramatic organizational and legislative actions have occurred in response to environmental problems. The most significant actions are the National Environmental Policy Act (NEPA) of 1969, which created the President's Council on Environmental Quality (CEQ): the creation of the U.S. Environmental Protection Agency (EPA) by Executive Order; the reorganization of numerous state and local agencies to form a separate environmental entity; the Clean Air Act of 1970; the 1972 amendments to the Federal Water Pollution Control Act; and a broad range of state and local legislation, from tougher standards and controls to greater appropriations for environmental activities. For these policies to be effective, environmental management has to integrate knowledge from a variety of fields and disciplines.

In the past few years increasing pressures have been brought to bear on public officials at the local, state and federal levels to produce positive results in the battle to preserve and enhance environmental quality. Consequently, elected officials and professional administrators who traditionally had the responsibility for certain environment-related programs are now expected to become "environmental managers." Unfortunately, the demands on public officials have outstripped the preparation and resources available to them for managing environmental problems; they are often not equipped to deal effectively to alleviate today's environmental problems and avoid the problems of tomorrow. Long range comprehensive environmental considerations must be part of nearly every decision made by public and private agencies. It is time to focus on the increased demands on environmental managers and augment their working knowledge and tools by developing a theoretical framework, methodology, and specific techniques to meet their new responsibilities. In fact, such activities are well underway. For example, the Office of Research and Development is helping to support an innovative and comprehensive project in San Diego, California, which utilizes sophisticated techniques to develop alternative methods of achieving mandated Air Quality goals. Authorities and responsibilities of the different levels of government must be defined. Coopration among governmental levels, industry, and citizens is essential for success in meeting the environmental challenge. For these reasons, the National Conference on Managing the Environment was conceived

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to address these problems and to open a dialogue between managers—public and private—on the environment and related issues.

A National Conference on Managing the Environment was held on May 14 and 15, 1973, in Washington, D.C. Approximately 350 persons, predominantly public officials of all levels of government, attended the discussions of various aspects of environmental management. The conference sessions covered the following topics: the environment, how comprehensive; interaction at the local level; a decision maker faces the environment; local government experience; regional government experience; legal and judicial constraints; public involvement; environmental technology growth; standards; comprehensive planning; intergovernmental relations; and four technical workshops. The following papers were either presented at the conference or were used as reference material for conference discussions. The chapter introductions in this book are designed to provide an overview and discussion of the key points raised by the papers presented in each chapter.

I: Prologue

Today's public official finds himself increasingly involved in the complex political, technical and administrative milieu surrounding environmental concerns. He is constantly affected by a variety of forces which simultaneously stimulate and constrain his actions. These forces include:

—*Unique ecological factors*, such as a fragile micro-ecosystem (e.g. natural desert, ocean beach or wildlife sanctuary) or special ecological conditions (e.g. location on an earthquake fault or susceptibility to temperature inversion);

—*Environmental crises* such as natural disasters, oil spills, smog alerts, and soil erosion;

—*Pressures from the political process*, as evidenced in the types of citizen participation, what groups see as environmental problems, the particular solutions they promote, and the extent of their influence on decision-making;

—*Unproven management strategies*, which result from a lack of working knowledge or insufficient analysis of effectiveness of alternative strategies such as environmental impact statements, land-use planning, environmental quality standards, financial incentives or penalties, growth controls, etc.;

—*Administrative dilemmas*, which focus on the issues of administrative organization goal-setting, resource allocation, measurement of effectiveness, and establishing a process for long-range, comprehensive decision-making;

—*Interdependent policies and programs*, both public and private, which may result either directly or indirectly in environmental degradation, such as programs to promote economic development, encourage resource development, finance transportation facilities or eliminate urban blight;

—*Technical considerations*, such as defining environmental quality, monitor environmental factors, and understanding the workings of the ecosystem;

—*Federal and state requirements*, which define the legal framework for local governments, set environmental quality standards, and mandate compliance with federal and state procedures (e.g., the environmental impact statement process).

COMPLEX ISSUES LEAD TO CONFUSION, POLEMICS

Given the multiplicity of forces at work, organizational arrangements and programmatic responses cannot be standardized, but need to be tailored to local and regional situations. In light of the complex operating framework and the development of many new environmental programs, local and state officials are uncertain about which programs are available and how effective they have been or potentially could be. Most of the literature to date has not addressed itself to solving environmental problems at the local and regional level. Instead, for the most part, the focus has been on polemic-style essays forecasting doom, descriptions of environmental crises and their consequences, pleas for broad national policies, or technical information regarding the functioning of the ecosystem. They do *not* address how a manager is to bring together the technical knowledge and the managerial skills for developing and implementing environmental programs. Thus the rationale behind EPA's motives in bringing involved environmental practitioners together to discuss the issues and solutions toward a rational approach to managing the environment.

In providing an overview for the conference on environmental management, Mr. Robert Fri, the Acting Administrator of EPA, said that:

> "in the brilliant burst of environmental awareness of the past few years, we have devoured most of the knowledge painstakingly built up over decades. We set six ambient air standards all at once. Now we will set no new ones for some time, because we don't know how. We consumed, in one act, years of research . . . But now we ought to invest in new capital—new ideas, new discoveries, new techniques— for the long struggle that lies ahead."

Mr. Fri explained that an ecologically well-managed society will 'require new sophistication of state and local officials, new means of reaching political decisions that encourage input by the average citizen, certain restraints on consumer habits and preferences, and above all a new set of values." For this sensitive intergovernmental balance to be successful, he noted that:

> "a necessary retooling would focus upon land use, transportation controls, energy planning, and an assessment of technology itself. . . . As we learn to design with nature, we shall create a higher form of civilization that is not only productive and efficient, but more orderly, humane, and beautiful as well."

GETTING THE PEOPLE INVOLVED

A critical aspect of environmental management is the issue of citizen involvement. Russell Train (I. 2), then Chairman of the Council on Environmental Quality (CEQ), called for active public participation in government decisions on environmental matters. He said, ". . . that management must have two key elements; first, the best information and feedback for decision making; and second, follow-up of decisions and tasks."

With the aid of an active, informed citizenry, Mr. Train commented that the administrator may be more accountable and responsive to citizens, and better equipped to cope with environmental problems. He said, "The public can provide an essential source of information—in providing an early warning system of the existence of problems, and then in holding bureaucratic feet to the fire to see to it that regulatory programs are implemented." Mr. Train stressed that the right of citizens to have an input into environmental decision-making is ensured through federal legislation, including the environmental impact statement process. In his view, "Only through such participation can we achieve that sense of mutual trust and shared purpose that will provide the essential strength not only for our environmental programs but for our society as a whole."

A commonly identified cause of our environmental problems is the over-use of technology. In taking exception to this Buckminster Fuller, inventor who developed the geodesic dome, said that, in his view, more and not less technology is needed to overcome environmental ills. He concluded, "It's an ignorance crisis we face, not a pollution crisis, or an energy crisis . . . But, above all, I think nature is really trying to make a success of man despite his ignorance."

A key issue addressed at the Conference was the ability of government to adopt effective environmental policies and programs. In a series of "Reflections" written during the conference, Kenneth Boulding, economist, University of Colorado, commented on the governmental response to ecological problems when he noted:

> "The quiet revolution of the planning of the land,
> At the state and local level may be very well in hand
> But one may have nagging doubts on whether guiding growth in quality,
> Is much within the power of any level of the polity."

United States Senator Hiram L. Fong, the ranking minority member on the Senate Appropriations Subcommittee handling environmental protection, said to the conferees that we must pay more attention to the costs of cleaning up the environment. He stated that:

> "One of our first goals must be to define more precisely what we mean by cleaning up and improving our environment. . . . We need to devise scales of values—scales of values that will show the cost in dollars, the cost in resources, such as fuel oil, power output, and energy input; and arrange these on a graph that will show all the costs in relation to each degree of quality of air or each degree of quality of water or whatever the environmental factors involved are. . . . We need to develop benefit-cost ratios for environmental projects."

POLLUTION DOES NOT DISCRIMINATE

Asserting that some prevalent goals which entail economic growth at any cost are becoming untenable, former EPA Administrator William D. Ruckelshaus sketches a "Prototype of Environmental Civilization." Our exploitation of natural resources may have passed the point of diminishing returns in terms of our quality of life, Ruckleshaus notes. "Today, not even the richest man can avoid the smog, the putrid waters, the noise, the stench, the congestion and the general ugliness of industrial civilization." He challenges us to "rethink some venerable assumptions. The fact is that we are confronted by serious imbalances, and they must be dealt with in a more sophisticated manner than heretofore." Finally, expressing his confidence in mankind's growing ability to act wisely, Ruckleshaus asserts that "man will not only survive, he will prevail."

reflections

By Kenneth E. Boulding

The movement for environment has been a big success
For people have become aware of rapid growth of mess.
And in the halls of Congress the environmental boys
Have legislated water, air, and pesticides and noise;

Now monitoring is the key to quality control,
Unless we know which way is up it's hard to reach a goal—
But the most effective monitor is public agitation
To keep a narrow expertise from governing the nation.

The involuntary system that is based upon the cell
Can manage billions of parts and do it very well,
So perhaps it's the development of arrogance of brain
That brings along environmental troubles in its train.

Environmental planning must be based upon a region
And even there phenomena are virtually legion,
And so the poor environmentalist is very very loath
To contemplate the consequence of exponential growth.

Equilibrium's a fiction of the ordered human mind
In the turbulence of nature it is very hard to find,
So we have to ride the rapids of a raging evolution
In the hope that our extinction isn't part of the solution.

The quiet revolution of the planning of the land,
At the state and local level may be very well in hand
But one may have nagging doubts on whether guiding growth in quality,
Is much within the power of any level of the polity.

As we don't know very clearly what we really want to do,
It would be dangerous to have too clear an end in view,
But if we can put a stopper on the scandalous and outrageous,
We may create a state of things where virtue is contagious.

A modest optimism may be entertained because
The air above the city streets is better than it was,
But one can permit some gloom about an ultimate solution
When the GNP's a symbol for Gross National Pollution.

A careful city government that sensitive and nervous is
Will pretty well confine itself to just providing services;
But if it gets courageous it may ferret out a new way
To defend its threatened people from invasion by a throughway.

I.1 Beyond the brushfires

Robert W. Fri *

The people of this country will be called upon to make many difficult environmental decisions during the 1970s. Their choices must be wise, for they will determine not only the quality of their own lives, but the prospects of civilization for generations to come.

The choices will be difficult, for problems are not transient phenomena to be wished away. It takes only the fuel shortages we have already had for us to realize that the earth's ability to supply us wtih the clean air and water, with fertile land, with minerals, fuels and wilderness—that this capacity is finite. We cannot create new air, land or water, so we must husband these resources. Surprisingly, we are just now relearning the husbandry our forebears knew so well.

But can we manage our environment wisely? To be sure, we have set the stage for control of the more obvious kinds of air and water pollution, but we have only begun to consider the subtler interactions between man and his environment. We are only now beginning to understand the complex web of forces that determines the quality of our life-forces such as land and energy use, transportation economic growth, urbanization, population, and the advancing juggernaut of technology.

Because we do not understand these forces, we still act as though every environmental issue were independent of its brothers. We struggle with each problem as though it were the first, and make each policy choice as though it were the last. Then another crisis grabs our attention, and we start the process all over again.

But it could be different. We could think ahead. For example, two decades ago, the nation's love affair with the automobile was entering its most lyrical phase. On the assumption that every American had a fundamental right to go anywhere at any time by car, we designed a national transportation system based largely on highways.

We now have the best highway network in the world and some of the best traffic jams, best pollution, best ugliness, best noise and a very advanced case of urban decay.

Yet it would have been a fairly simple matter to have measured the pollutant output of the average automobile, analyzed a few airsheds, projected highway usage, factored in population growth and devised a reasonably accurate forecast of air pollution in 1970. All that could have been accomplished using data and techniques available in the early 50's.

Systematic approach needed

Thus, with a little foresight, we would not have had to deal with the emissions problem on an emergency basis. Much of the damage to health, property and vegetation in the interim might have been avoided, if we had only thought more systematically about the problem.

Managing the environment as a system is complicated. However, it is no secret to the well-informed that we have the information to develop a systems solution to a great many of our ecological problems now. We do not need any fabulous breakthroughs or quantum leaps to at least get started on the design of an environmentally integrated society.

It is simply common sense, cheaper, and more effective to solve problems in tandem and to plan ahead.

The situation in San Diego is instructive. In 1971 some 158,000 tons of volatile organic compounds were being dumped into the county airbasin from all sources. Auto emission and stack gas controls were clearly not enough to meet federal standards. So the county promulgated rules to stop the evapora-

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*Presented by Robert W. Fri, Acting Administrator, U.S. Environmental Protection Agency at the National Conference on Managing the Environment.

tion of hydrocarbons throughout the gasoline transport network—loading of storage terminals, filling of trucks, transfer to service station tanks and even filling up the customer's car.

The technology for capture and recycling of vapor from large storage tanks was already known. The challenge was to create a closed loop system embracing all four fuel transfer points.

San Diego, therefore, decreed that all gas handling vehicles or facilities with tanks of more than 550 gallon capacity must use special nozzles to prevent escape of any vapors whatever. At the service end a low vacuum system draws the vapor back into the station's own tank or into the truck itself, and the excess can be tranpored back to the tank farms for condensation and remarketing.

It pays to be clean

It sounds clumsy, but such an arrangement will pay for itself within seven or eight years, which is about the same time it takes to amortize the cost of a service station. In a time of fuel shortages and rising prices for gasoline, the projected 90% recovery rate for evaporated gasoline should commend itself to all of us. The typical big commercial station—to which the rules apply—will save $200 per year in recycled gasoline and San Diego county as a whole will save 6.15 million gallons of gas per annum.

This is one of that increasing number of cases in which a system approach to pollution control pays off for everybody: the community, the businessman, the national energy planner and even the customer. It is cheaper, faster and less prodigal with resources.

But there are dangers. Too often, the magic word "system" hides our ignorance. Worse, we fall into the trap of thinking our work is done when we discover a theorteical or engineering "solution" to our problems. Systems thinking and long-range planning are not the whole answer to anything.

The more difficult question is: "who is going to apply all this sophisticated knowledge?" In solving environmental problems, the burden will fall, as it often does now, on the shoulders of state and local governments. Systems thinking does not change the reality that these levels of government remain closest to the problems, and are most able to determine what should be done and what is possible.

First, to be effective in the struggle against pollution in all its protean forms, local governments must develop a new expertise unlike anything we've seen before. The first step involves the development of the professional capacity to handle such tools as operations analysis, long-range multifactor forecasting, airshed models, land planning, traffic simulations and the like. More difficult will be learning how to apply this capacity to the day-to-day grind of running government. State and local officials should test out the scientific techniques we in EPA are testing and let us know what works and what does not.

The next demand on local governments will be to forge new alliances among themselves and with water districts, air pollution control commissions, zoning boards, and planning groups. We must end the fragmentation of local responsibility for managing the environment, for the environment routinely overlaps ancient and arbitrary jurisdictional lines. It makes no sense, for example, to exclude San Bernardino from the Los Angeles air pollution control district when the prevailing winds blow east.

Indeed, perhaps the most difficult political task local government will face in the next ten years will be to bring many separate authorities to bear in a coordinated way on problems that do not and cannot yield to piecemeal solutions, no matter how much we yearn for bygone days of more or less complete autonomy.

A challenge to growth

It is particularly important to examine critically the great American shibboleth known as growth. It is our own special sacred cow, and in its most exaggerated form it makes environmental managment difficult if not impossible. It is the antithesis of stability.

An ecologically well-managed society will be quite different from the one we are familiar with. It will require new sophistication of State and local officials, new means of reaching political decisions that encourage input by the average citizen, certain restraints on consumer habits and preferences and, above all, a new set of values.

We may have to make do—indeed, we must learn to want to make do—with smaller cars, with less energy, with recycling our wastes instead of throwing them in the city dump, and adjusting the size of our families to responsible norms. We will have to stop treating the good earth as a mine to exploit and start treating it as a single, fast-shrinking neighborhood where every man labors for the good of all.

Years ago, they would have said we've been eating our seed corn. For in the brilliant burst of environmental awareness of the past few years, we have devoured most of the knowledge painstakingly built up over decades. We set six ambient air standards all at once. Now we will set no new ones for some time, because we don't know how. We consumed in one act years of research.

For let there be no mistake about it—getting control of air and water pollution will be simple compared to solving the higher problems of an advanced technological society. We must go beyond enforcement, important as that is, and focus more sharply on land use, transportation controls, energy planning and an assessment of technology itself.

Nor is it a task for lawyers or scientists or public servants acting alone; it demands cooperation, breadth of mind and openness to change. The greening of America will be largely up to the creative leadership of public health and pollution control departments, mayors, council members, regional planners and county officials, working with citizen groups to devise action plans for the integrating environs of tomorrow.

The society of the future will be more orderly and efficient than the one we have known. We will enjoy longer lives and better health. We will waste fewer resources. We will not be so obsessed by quantity in lieu of quality.

Man in natural habitat

I believe we will realize once again our true dependence on the biological world. Environmental attitudes will be built-in, so to speak, not a topic for debate or study but a way of life. As we learn to design with nature we shall create a higher form of civilization that is not only productive and efficient, but more orderly, humane and beautiful as well.

Then man will truly be the steward of the earth, and a wise guardian of unborn generations.

I.2 Management for the future

Russell E. Train *

Three years ago when the National Environmental Policy Act was first enacted, I called it a "new experiment in government." It certainly constitutes one of the most significant legislative reforms in many years.

While the ultimate success of that experiment cannot yet be measured, it has already demonstrated extraordinary success and is generating basic reforms in the way our government does business. Of particular significance is the fact that these reforms have enlisted the energies not only of Federal agencies, but also of the Congress, the Courts, State and local governments, industry and, most important of all, private citizens and organizations all across the country. The truly extraordinary dimensions of this involvement provides a societal breadth to environmental decision making which is completely unprecedented and which provides its greatest promise for the future.

Creating an institutional base

It has only been a few short years since environmental concern first gripped the public attention. As Government began to respond to the growing public demand for action, we found the institutional base for environmental management either badly fragmented or even in some critical areas nonexistent. Thus, the first urgent need was to create an effective organizational framework for both policy-making and administration and to provide the basic statutory authorities for standard setting and regulation. On both these fronts, we have made remarkably strong progress over a short period of time. CEQ and EPA have been brought into existence. While I might be accused of self-serving if I said that CEQ has achieved notably success in strengthening environmental policies both domestically and internationally, I feel under no such constraint in saying that EPA has become a strong and effective force record, in its little more than two and one-half years life, is one in which all of its personnel can take great pride. Beyond these organizational changes, strong new water quality legislation, the Clean Air Act, new pesticides legislation, and laws to regulate noise and ocean dumping are now on the books. These represent major successes. There, of course, remain a number of important items for legislative action recommended by the President on which we still need Congressional action. Strip mining regulation, national land use policy, toxic substances control—these are among the high-priority items on which we will continue to press the Congress for early approval.

At the same time, I think it fair to say that increasing emphasis must now be given to effective implementation of existing programs under sound environmental management principles.

Key management elements

It seems to me that management must have two key elements:—first, the best information and feedback for decision making;—second, follow-up of decisions and tasks. Today I wish to talk particularly about two information inputs to environmental decision making and management. The first of these is monitoring, to which I would also add improving our research data base. The second is citizen participation.

Accurate and timely information on the status of the environment is necessary to shape sound public-policy and to implement environmental quality programs efficiently. It is virtually impossible to develop effective programs and to monitor their implementation without good monitoring data. Very detailed data are necessary for certain types of planning and enforcement. For top management and general public

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*Presented by Honorable Russell E. Train, Chairman, Council on Environmental Quality, at the National Conference on Managing the Environment.

policy development, monitoring data must be shaped into easy-to-understand indices that aggregate data into understandable forms. I am convinced that much more effort must be placed on the development of better monitoring systems and indices than we have had in the past. Failure to do so will result in sub-optimum achievement of goals at much greater expense. The critical relationship of good monitoring data to state implementation plans under the Clean Air Act is obvious. Our increasing recognition of the impact of nonpoint sources of pollution on water quality is largely based on the recent development of new monitoring data. Effective strategies for dealing with this problem can only be developed in conjunction with continued improvement in this data base. These are a few of many possible examples.

The need for constantly improving our research base, both for the identification of environmental problems and environmental standards, becomes greater all the time. The effects of pollutants on human health and other values must be determined as accurately as possible and the economic and social impacts of alternative regulatory systems analyzed in order to help provide a basis for the most effective control strategies. And, of course, the need for research extends across the entire environmental field—not just to the management of pollution control programs. Thus, for example, the complex impact on natural systems of water resource projects such as stream channelization should be determined by adequate research and the resulting data should be built into the decision-making process. I emphasize "built into the decision-making process" because there are vast amounts of research data available that are too seldom utilized. Likewise, as we develop our monitoring systems, these too must extend beyond pollutants to fish and wildlife, forests and vegetation generally, wetlands, soils, etc. My strong impression is that we are not doing an adequate job of monitoring in these areas.

Including the citizen

Turning now to citizen participation, I will state my absolute conviction that this is the single most important ingredient in the environmental management process.

The environment is just too important to be left to us bureaucrats.

We have been making progress in improving citizen participation—largely under the prodding of the National Environmental Policy Act—but we need to do far more. Government at all levels must dramatically change its attitudes about public participation in environmental decision making before we can have truly effective management systems. We must really level with the public. It is an unfortunate fact that many consider public hearings and public disclosure of environmental impact analyses as simply delaying orderly management. This view is absolutely unacceptable.

Public participation provides critical inputs from those who actually live in the particular environment at issue. The public can provide an essential source of information—in providing an early warning system of the existence of problems, in developing realistic solutions to those problems, and then in holding bureaucratic feet to the fire to see to it that regulatory programs are implemented. Recently, I heard the point made that when the supertanker terminal was under consideration at Machiasport, Maine, the most influential element finally was the negative opinion of the local lobster fishermen whose intimate knowledge of tides, currents, fog, and hidden rocks convinced them that the proposal involved unacceptable risks.

The limits to expertise

In our increasingly complex technocratic society, there is a strong tendency to leave the problems to the experts. This is a tendency that should be strenuously resisted. We need technical expertise but, left unchecked, expertise alone, not moderated by a broader scale of values, will often fall far short in solving complex problems and may even create new problems in the process. Likewise, government management must not be merely the province of the technocrats. We in the government are just not that smart—or wise. Only by laying out the alternatives for public comment can we get a full range of alternatives as well as some consensus among those governed. Thus, public participation in decisions must be an integral part of good public management, and particularly of environmental management. Only through active citizen involvement can we set goals that have the consent of the public. Only through public participation can we have a truly effective control and feedback program. Thus, for example, in promoting new technologies and in making choices between alternative technologies, an essential element of the assessment process must be a determination of the relationship between particular technological goals and human values. Such a determination cannot be made in splendid bureaucratic isolation but only as part of a process which opens itself to the full interplay of ideas and values within our society. And, of course, the need for such openness and interaction extend across the full range of government decision making and to all levels of leadership.

Related to this problem is the fact that, all too often, resource managers begin to believe that they are engaged in managing their own resources—their own forests, their own river basins, their own fish and wildlife and rangeland, forgetting that we are acting as custodians of these resources for all the people. We cannot exercise such a trust responsibly or effectively unless we concientiously bend every effort to encourage public participation in decisions affecting the future of these resources. Again, this need for a sense of public trust on the part of administrators extends across the board. Administrative arrogance is almost a certain guarantee of failure of public understanding, loss of public support, and ultimately of wrong decisions.

Environmental impact analysis

In the environmental impact analysis process, we have a magnificent new managerial tool that can help serve the objectives I have described. It is admittedly an uncomfortable process for the bureaucrat. No program official enjoys making an objective analysis of the impacts of his proposed project, or admitting that there may be alternative courses of action, or making his proposal available for public comment by other agencies, by State and local governments, or by the public.

That the 102 process has stopped some projects and delayed others is plain but this alone is not reason for criticism. Most likely the projects should have been stopped or should have been delayed. The fact is that the environmental impact analysis process is a major step forward in providing more comprehensive, systematic, interdisciplinary and sophisticated decision making. Most of the significant problems which our society must deal with today are inherently complex. They defy traditional management approaches, organizational boundaries, and bureaucratic compartments. Thus, the highway planned by the Department of Transportation affects the mass transit goals of the same agency, impacts on fish and wildlife habitats of concern to the Department of the Interior, gives rise to air and water pollution and noise problems of concern to EPA, and may set in motion forces affecting patterns of economic and population growth which are of concern to our entire political structure. The environmental impact analysis process provides an integrative force in decision making which seeks to avoid bureaucratic tunnel-vision and to require comprehensive consideration of all relevant concerns. Of paramount importance to this process is the requirement for public disclosure and the opportunity for public comments.

There is no question in my mind that the NEPA process provides one of the most significant administrative reforms in the history of our government. Its continued vitality is essential to sound environmental management. It is incumbent upon all of us to see to it that in every agency the NEPA process has the necessary staffing, funding, and top-level support to make it truly effective.

Maintaining our democracy

Throughout these remarks I have stressed the importance of public participation to good environmental management. There is another reason for encouraging such participation on which I would like to touch briefly. As our technocratic society becomes increasingly overwhelming in both size and complexity, the average citizen feels further and further removed from the reality of decision making. He feels incapable of influencing the forces at work around him and events take on an air of seeming inevitability. This is a tendency against which we must fight because it can only lead to alienation from and cynicism with the essential workings not only of government but of society as a whole. Environmental programs provide a magnificent opportunity to give private citizens a new sense of responsible participation in the social process.

Finally, as we seek to improve management techniques for environmental quality, it is essential to remember that technique alone cannot secure environmental goals. Systems analysis, managerial skill, and technical expertise can help define problems, present alternatives, and identify costs and benefits. However, to be truly effective as part of a positive and creative process, analysis must proceed within the context of positive purpose. Analysis alone can become a largely negative force, better adapted to defining what not to do rather than what to do.

With the increasing complexity of the problems of the environment as well as of our society generally, we need urgently to improve our analytical skills and capability. But with this there must be a sense of purpose, of goals, and of values. To provide this value framework within which managerial skills can be exercised is the true role of leadership. Without it, all of the managerial competence in the world can produce only sterility. Cost-benefit analysis can illuminate choices but it cannot give direction. Thus, above all else, effective management for a high-quality environment requires policy commitment at all leadership levels.

Let me close by once again emphasizing that direction and purpose in our public affairs can best be achieved in an open process that fully engages the participation of the public. Only through such participation can we achieve that sense of mutual trust and of shared purpose that will provide the essential strength not only for our environmental programs but for our society as a whole.

I.3 A prototype of environmental civilization

William D. Ruckelshaus *

The first time I flew to California I was overwhelmed by the complexity and diversity of this State.

My hosts reminded me that if independent, California would be a major power, boasting an economy larger than any other except our own, Japan or the Soviet Union. They pointed out that it is a sort of sub-continent, spanning most of the earth's biomes and climates. They told me with an unmistakable pride that California embraces every kind of topography, that it enjoys vast mineral wealth and agricultural resources, that it has some of the finest parks and most extraordinary landscapes in the world. Moreover, they continued, the State entertains every conceivable ideology and idiosyncracy, and some are inconceivable too.

Like any newcomer I could not take it all in the first time around. On subsequent trips I gained an instinctive feeling that California is not only a microcosm of the United States, but also a prototype of what it may become. Many of our problems have been anticipated here: problems of prosperity, growth, development, urban sprawl and pollution. Not surprisingly, California is vocal in demanding sensible solutions. There is a stark realization that we have not treated our heritage of bright skies, open land and sparkling waters as we should have, that perhaps we grew without thinking about all the social and environmental consequences of a machine-oriented civilization.

No nation in history has ever developed as fast as the United States. Starting virtually from scratch, we created in one century the world's first industrial society on a continental scale. Since we derived great benefits from the exploitation of natural resources, it is understandable that we equated all forms of development with progress. Growth was justified by our successes, and sanctioned by reference to Holy Scripture. We obeyed the injunction to be fruitful and multiply and take dominion over the earth, but we ignored the careful husbandry the sacred text also calls for.

Questioning growth

Today, however, there is a new mood in this country. People are disposed to look more carefully at their assumptions, including those that have brought them wealth, comfort and convenience.

It is striking that no generation before ours has been quite as obsessed with growth itself. Prior to World War II, heavy emphasis was placed on employment and income, but little attention was paid to the Gross National Product. Marshall Goldman, the specialist in comparative economics, has reminded us that for some time after the war we did not even have annual GNP readings. The concept of GNP was largely historical until the Soviets goaded us with their relentless emphasis on growth rates. So we may have been sandbagged into competing on their terms instead of ours.

Both we and the Soviets tend to forget that at best GNP is only a rough indicator of national progress. It embraces all the elements of our economy including the production of luxury goods, first-aid for highway accident victims, the operation of prisons, medical treatment for people made ill by air pollution—and many other expendi-

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*William D. Ruckelshaus is the Former Administrator of the U.S. Environmental Protection Agency.

This speech was delivered to the Comstock Club, Sacramento, California, Octoberber 17, 1972.

tures necessitated by circumstances instead of volition. Such outlays are evidence that growth is a more complicated matter than one might think at first.

Take resources as another example. It has been estimated that if the U.S. and other nations maintain consumption at present rates, all known reserves of zinc, lead, tin, copper, petroleum and other materials will be exhausted within 30 years. It is obvious that we are running short of easily recovered surface deposits—those that gave such a boost to the industrial revolution 200 years ago. Modern technology may replace many of the disappearing substances or recover them from deep mines or deposits on the ocean floor. But the heavy cost of such operations means that mineral resources are bound to become more expensive.

Use it up, throw it out . . .

To bring the problem of diminishing returns close to home let me remind you that before this day is over each one of us will generate six pounds of solid waste, drain three gallons of irreplaceable oil from the earth, dump 40 gallons of sewage into the rivers and use paper equal to one-eighth of a mature tree.

Such rapid through-puts generate a tremendous impact on the environment and on the quality of our lives. Today, not even the richest man can avoid the smog, the putrid waters, the noise, the stench, the congestion and the general ugliness of industrial civilization. He may escape them on a fishing trip, but as an angler I've found that when everyone else gets the same idea at the same time, you're in for some real aggravation.

Anyone who has visited the national parks or dwindling open beaches knows at first hand the impact of population and prosperity on our finite resources of land and natural beauty. It is hard to believe, but true, that the National Park System recorded 79 million visitors in 1960, 121 million in 1965 and 186 million in 1971. The 200-million figure is only a couple of years away.

People pollution

Unless something is done, the serenity people seek in nature will be destroyed by their own numbers. That's why several States are trying to regulate the trend toward ever-increasing resident populations and ever-increasing hordes of tourists competing for space.

For example, the Colorado Environmental Commission is calling for a ceiling of 1.5 million inhabitants for cities in that State. The public has been advised that water-expansion programs will generate a rising tide of population growth, pollution, traffic jams and loss of the very amenities that brought people to Colorado in the first place.

This same concern is emerging elsewhere. Vermont has set up a statewide zoning system to protect ecologically fragile areas. Wisconsin has announced it will establish a policy to prevent unbalanced growth. Oregon is considering the constitutional implications of controls on tourism as well as on permanent immigration. Hawaii is contemplating optimal population limits. Florida just passed a tough land-use bill. Delaware has outlawed heavy industry along her beaches.

Here in California, Livermore and Pleasanton voted to prohibit permits in areas where schools are overcrowded, where water rationing is imminent or where sewage facilities are inadequate. Sacramento County has established its now-famous urban limit line. Several other communities have acted against growth in its classical form. I was surprised to see that the drastic Proposition 9 got 35 percent of the primary vote a few months back. And now, a new referendum is to be held* on the question of freezing development of the California coastline.

Meanwhile, the California Supreme Court has held that the State's Environmental Quality Act applies to licensing of private activities as well as to State projects. This interpretation, perhaps inspired indirectly by the National Environmental Policy Act, made instant hash of California building permit procedures. In a recent *Washington Post* column, Joseph Kraft said the permit problem "symbolizes a dramatic change in the message which this area . . . has been transmitting to the rest of the country. No longer does it offer the prospect of growth unrelenting; no longer does it proclaim the case for go, go, go."

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*The referendum was approved by the California electorate.

Another California court ruling—to my knowledge the first of its kind in the Nation—holds that municipalities can force developers to set aside land for public purposes notwithstanding the provisions of the State constitution requiring compensation for land taken or damaged. This expansion of the historic doctrine of eminent domain gives local governments vast new powers in recreational land planning, watershed management and wilderness protection.

I cite all of these initiatives not to endorse them, but to call attention to the rapid shifts in public attitudes that make them possible. Californians, like other Americans, are beginning to ask certain fundamental questions about life values—and since this State is more developed than most, I would not be surprised if it becomes a major point of collision between pro-growth and anti-growth forces in coming years.

Exponential growth

Let me give you a few examples of exponential growth in order to clarify and promote dispassionate analysis of our environmental dilemma. It is easy to overlook how rapidly a phenomenon can get out of hand when it grows at a compound rate. But one instructive analogy was developed by the 17th century French philosopher and mathematician Pascal, who amused the neighbor children with a riddle based on the growth rate of lilies and how rapidly they approach a fixed limit determined by nature.

Suppose you own a large pond with one lily in it. The plant doubles in size each day and will choke the entire pond on the 30th day. On the first day, it is only one-five-hundred-thirty-seven millionth the area of the pond. You have plenty of time, so you decide to wait and trim the lily back when it covers half the surface.

For the first ten of the 30 days, the plant is less than one-millionth the size of the pond. Between day 10 and day 20, it grows from one-millionth to one-thousandth of the available area. That is a large relative increase but you're not worried because 99.9 percent of the pond is still open and biologically healthy.

As dawn breaks on the 25th day, the lily is still only one-thirty-second the size of the pond. The final explosion is fabulous to watch—an inexorable progression from one-sixteenth to one-eighth to one-fourth and finally to one-half on the 29th day. You have one day in which to restore the living balance and save your pond.

The same law of exponentiality applies to animal populations. Under optimal stimulae they quickly expand to the physical limits of land or marine habitats. The closer they approach those limits, the more drastic is the ensuing die-back.

We see numerous examples of animal population collapse brought on by shortages of food, impedance of territoriality and interference with breeding patterns. Many experts believe mankind is also heading toward a demographic "implosion."

But vanishing resources and overpopulation are not the only problems we face. Some are extremely subtle; indeed, geometric processes are even visible in the realm of industrial investment. During this year, investment in industrial facilities is expected to grow by 10.2 percent. At this high rate, capacity would double every seven years. Thus if pollution control technology is 85 percent effective in existing plants it will be just 70 percent as effective in cutting gross pollution tonnages seven years from now when production of everything, including contaminants, has doubled, and only 40 percent as effective seven years hence, when it has doubled again. After three successive seven-year doublings, the actual amount of pollution is 120 percent more than it was 21 years earlier before abatement began, even assuming pollution control at a remarkable 85 percent effectiveness level all along.

Thus exponential growth in industrial capacity ultimately—and not very far in the future at that—could require almost perfect abatement technology to assure just an adequate level of amenity and health, let alone the high standards we might prefer. This outcome is postponed somewhat in an economy gradually switching over to services from heavy goods, but the example would nevertheless hold true for the world as a whole.

Earth as a closed system

One could go on and on with such analogies—in the dissemination of chemicals, in solid waste disposal, in effects on world energy balance and climate, ad infinitum. Everything is linked to everything else in the closed system of the planet Earth. Certainly the facts as we know them require the asking of the most basic questions. Will Draconian measures of pollution control be necessary? Are large populations compatible with high standards of living over the long-haul? Can we continue to unbalance natural processes—wiping out hundreds of plant and animal species—without paying a fateful penalty- Such profound questions cannot yet be answered with confidence. The analogies may be correct, or they may be empirically worthless.

One international group of scientists and businessmen earlier this year attempted to project into the 21st Century the consequences of present trends in population, resources, investment, food technology and population. The Club of Rome developed a computer-based forecast purporting to show that we are in for real trouble within the next 50 to 100 years—and perhaps disaster—unless we cut back on growth now and eventually reduce it to zero.

Such a proposition strikes most of us at first as absurd. Scholars both here and in Europe have faulted the Club's statistical methods on one ground or another. Yet the study did cast a spotlight on certain implications of current growth patterns. It challenged us to rethink some venerable assumptions. The fact is that we are confronted by serious imbalances, and they must be dealt with in a more sophisticated manner than heretofore.

My hope is that the Club of Rome projections will prompt a great national and international debate on broad philosophical issues stemming from technology and industrialism on a world scale. Thanks to the agreements recently concluded by the President, we can count on the Soviets to contribute their insights to this historical reanalysis.

Maybe the concern and even alarm in some quarters will turn out to be groundless. Certainly, the prophets of doom have on many past occasions gathered us together to await the Day of Judgment, and nothing has happened. That may be the case this time. But prudence, and what Jefferson called an appropriate deference to the opinions of mankind, require us to get our heads just a little further out of the sand and go after some solid answers. We in EPA and others all over the world are eagerly pursuing the research leads that can give us the information we need.

I am certain of one thing only: environmental pressures are just beginning. States and local governments and business leaders should respond to this pressure, not just reactively, but aggressively seeking opportunities to act as social catalysts. That is the only way we can preserve faith in a free economic system and a free society.

An environmental civilization

The shift to an environmental civilization will not be easy, fast or cheap. But there is growing national consensus that it must happen. People are tired of change for the sake of change. They want progress for a purpose. They are embracing a new consciousness, a new vision of reality, a new sense of their place in nature. They are ready to practice a new stewardship of the earth.

Mankind has hung on, somehow, through dark millennia of ignorance, disease, torture, starvation and endless warfare. We are beginning to see the truth about ourselves and to act wisely. So I do have faith that we can overcome. In my opinion man will not only survive, he will prevail.

II: The Environment as a Policy Issue

Several Conference sessions were aimed at highlighting dimensions of the environment in the hope that better understanding will improve programs for environmental management. United States Senator Hiram Fong, keynoting the second day of the Conference, remarked:

> "Managing our environment runs the whole gamut of land use, water resources, conservation, air pollution abatement, energy conservation, the beauties and bounties of nature. It requires a wide spectrum of disciplines in science and technology, in law, in administration, in legislation. And above all, it requires citizen participation and citizen support."

Thus, the study of environmental problems and the complex relationship between man and his environment must integrate the knowledge and theories from a variety of disciplines including biology, chemistry and physics from the physical sciences, and economics, anthropology and sociology from the social sciences. Although scholars in the disciplines involved in environmental matters should work together in formulating solutions and integrating knowledge on environmental problems, this has not always been the case. By bringing together speakers from diverse backgrounds, the Conference sessions attempted to probe the various dimensions of the environment.

The purpose of this chapter is to integrate views and ideas of the environment as a policy issue. First, the concept of the ecosystem is defined and its more controversial characteristics discussed. The next section focuses on the issue of environmental quality as it relates to economics and economic growth. The discussion reflects the interrelationships between environmental policies and economic, scientific, defense, and domestic policies. The third section examines environmental problems and their potential solutions from the perspectives of decision makers—both government officials and corporate executives. Finally, the chapter concludes with a discussion of environmental decision-making in the context of rational and incremental decision-making.

THE ECOSYSTEM: A PRIMARY CONCEPT

The basis for developing more effective public policies and programs for solving environmental problems may lie in our ability to develop a unifying concept to coordinate the factors related to environmental quality. One such concept is that of the ecosystem or ecological system. While it was developed primarily in the biological sciences to represent the relationship between organisms in a specified community, the ecosystem has been broadened to include social factors as well.[1]

The ability of an environmental manager to be effective may depend on his knowledge of the intricate workings of the ecosystem. In searching for a simple definition of ecosystem, we can refer to a biologist who was one of the first to use this concept: Eugene Odum, presently director of the Institute of Ecology at the University of Georgia and former president of the Ecological Society of America. He defines the ecosystem as a unit of biological organization made up of all of the organisms in a given area (community) interacting with the physical environment, so that a flow of energy leads to characteristic trophic structure and material cycles within the system.[2a] In this definition, the problem of technological development may not be adequately treated.

In an effort to be more inclusive, during his presentation, Kenneth Boulding, Professor of Economics, University of Colorado, presented a broader definition based on his work in economics and systems theory. He defined the ecosystem as:

> "a system of interacting species, a species being any set of elements, each of which conforms to a common definition, the total number of which is a population which can be added to by the formation of new elements (births or production) and can be subtracted from by the disappearance of old elements (death or consumption).'

Dr. Boulding argued that the products of man's technological development, which he labelled artifacts, must be regarded as an integral part of the ecosystem. For example, the automobile is as much a species as the horse. It has an input of materials from mines and an output of materials into a dump, and it is nourished by gasoline and excretes carbon dioxide, carbon monoxide, and nitrous oxide. Although man has produced many changes in the ecosystem, the accumulation of many technological developments, like the automobile, has the potential for creating even greater and more rapid changes in the ecosystem. It is important to remember that survival of the ecosystems depends on a cycle of materials and a source of energy. For example, the increased use of household appliances and new food products, both designed to simplify domestic activities, have had drastic effects on the cycling of materials and energy consumption, thus threatening the future existence of some ecosystems. In defining components of the ecosystem, therefore, technological developments should be included.

TECHNOLOGY DISRUPTS ECOSYSTEMS

Moreover, man has a tendency to use these technological developments in ways that disrupt the normal functioning of the ecosystem. Ecosystems vary in their tolerance to change and effects of single pollutants. There are certain ecosystems where sources of air pollution should not be concentrated. However, certain physiographic regions attract uses to which they are intolerant. For example, regions which exacerbate pollution, such as a stagnant-air valley, may be the location for sources of toxic emissions. Another example is the estuary marsh ecosystem which may be used for ports and refineries for which they are unfit. The concept of "fitness" therefore becomes critical in applying the concept of the ecosystem to environmental planning and management.

To achieve environmental "fitness," Eugene Odum has postulated a model of ecological succession.[2b] Ecological succession involves the development of ecosystems, paralleling the developments of biological organisms and human society. It may be defined by three parameters:

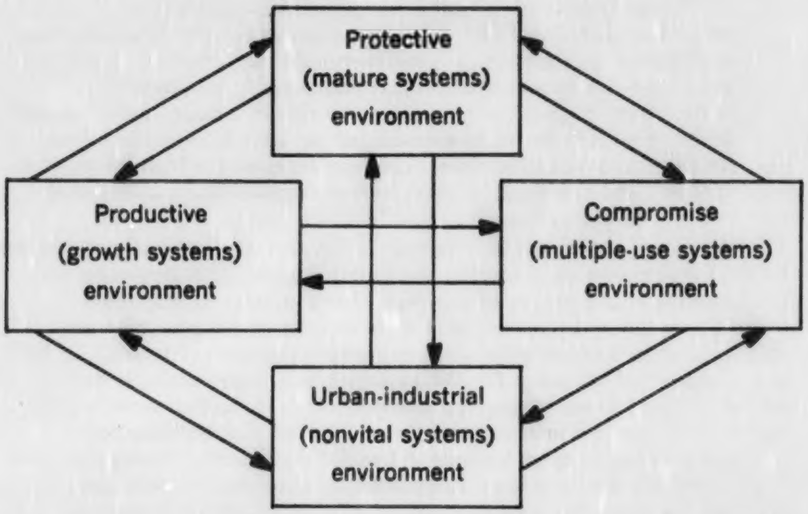
> (i) It is an orderly process of community development that is reasonably directional and, therefore, predictable. (ii) It results from modification of the physical environment by the community; that is, succession is community-controlled even though the physical environment determines the pattern, the rate of change, and often sets limits about how far developments can go. (iii) It culminates in a stabilized ecosystem in which maximum biomass (or high information content) and symbiotic function between organisms are maintained per unit of energy flow.[2c]

The strategy of succession is to increase control of the physical environment by achieving maximum protection from perturbation. It is important for the environmental manager to recognize that a strategy of maximum protection in trying to achieve maximum support of complex biomass structures often conflicts with man's desire of maximum production. To help in environmental planning, Dr. Odum argues that more emphasis be placed on compartmentalizing the environment in order that growth-type, steady-state type and intermediate-type ecosystems may be linked with urban and industrial areas for mutual benefit. He presents a compartmental model in which the basic kinds of environments required by man are classified according to biotic function: [2d] (1) productive environments characterized by growing ecosystems, (2) protective environments which are mature ecosystems, (3) compromise environments which are multiple-use ecosystems, and (4) urban-industrial environments which are nonvital ecosystems. According to Odum it would be possible, by using computer simulations, to determine the limits that might be imposed on each component ecosystem in order to maintain regional and global balances in the exchange of vital energy and materials. The information could be used for high yield agricultural purposes and for urban sprawl—two potentially destructive land uses. In conclusion, he argues that:

> "A balance between youth and maturity in the socio-environmental system is, therefore, the really basic goal that must be achieved if man as a species is to successfully pass through the present rapid growth stage, to which he is clearly well adapted, to the ultimate equilibrium-density stage, of which he as yet shows little understanding and to which he now shows little tendency to adapt." [2e]

Whether equilibrium exists in the ecosystem, as presented by Dr. Odum, is undergoing serious debate and analysis. Ian McHarg, Urban Planner and Professor, University of Pennsylvania, points out that the ecosystem is in a dynamic balance where the equilibrium point is in a state of flux. In taking exception to this, Dr. Boulding states that equilibrium in a literal sense is virtually unknown in the real world. Only approximations of equilibrium really exist, since it is difficult to conceptualize a disequilibrium process. C. S. Holling and M. A. Goldberg provide another perspective.

COMPARTMENTAL MODEL OF ECOSYSTEMS[2d]


Protective
(mature systems)
environment
Productive
(growth systems)
environment
Compromise
(multiple-use systems)
environment
Urban-industrial
(nonvital systems)
environment

They argue that since the ecological system is not in a delicate state of balance but rather in the process of developing, the key feature of the system is resilience. The internal resilience is the ability of the ecosystem to absorb incremental changes. For example, long before man, the ecosystem experienced traumas and shocks imposed by climatic changes and geophysical processes. Ecosystems have been able to absorb and adapt to these situations. Only when massive shocks occur or incremental changes accumulate is the resilience exceeded, thus generating dramatic and unexpected signals of change.

ENVIRONMENTAL QUALITY AND ECONOMICS

From the discussion of ecosystems, it is evident that successful functioning of the ecosystems depends to large degree on the total social system and related policy. For example, United States science policies, which involve the direction of scientific research and the allocation of funds for research and development, play a large role in determining the types of technology available for production and consumption. The efficiency of these technologies and their use of natural resources will affect environmental quality. Other policy areas with environmental consequences include transportation, housing, urban development, health, agriculture, and economics. One of the issues focused on at the Conference was economics and its relation to environmental quality.

The economic system's major function is to govern the artifacts, skills and services which are exchanged in a society. Economic growth is the major goal in a capitalist economy. In attempting to achieve such growth, the economic system regulates the use of natural resources in the ecosystem and the disposal of waste into the ecosystem. The buildup of residuals—leftovers of production and consumption activities—has become a major environmental problem. The resilience of many ecosystems is being tested by this accumulation of residuals. As a result, our society may no longer be characterized as the "affluent" society but rather as the "effluent" society.

The quest for survival requires the use of various elements in the ecosystem. As pointed out by Professor Boulding, virtually all human activity produces both good and bad effects; this is why we have pollution. He continues that:

> ". . . not because there are wicked people who like to pollute things (this is a very minor element in the problem), but because if we want beef, we have to have polluting feedlots, if we want electric power, we have to have polluting power stations, and so on. A critical problem in the economy is how to make private decisions for private benefit also produce public benefit."

Before the development of sophisticated technologies and the proliferation of consumer demands for goods, natural resources were used without limit and waste was dumped into the environment where it would dissipate. A prevalent belief was that one person alone could not cause environmental damage since air, water and other natural resources were so plentiful. However, our pursuit of economic growth and the accompanying high standards of living, drastically increased the amount of natural resources being used for production and consumption, and the amount of wastes being discharged into the environment. By 1960, many scientists were beginning to identify some negative consequences of massive industrialization, more sophisticated technology, and rapid economic growth. As Professor L. J. Battan states:

> "The atmosphere is often treated as a garbage pail of infinite size. Obviously, this is a serious mistake. Our layer of air should not be regarded as a dumping ground in any circumstances. The quantity of pollutants that can safely be put into the air depends on the property of the atmosphere at the moment of release and subsequently. In some periods a great deal of smoke can be added with little danger. At other times the condition of contaminants must be kept at an absolute minimum." (3)

Even today, some economic policies support the myth that the environment can be abused without limits. There are several reasons for this.

POLLUTION WITHOUT PAYING

First, a person is generally not directly affected by the pollution and possible environmental damage he creates. The consequences of his means of production and consumption are felt by his neighbors. For example, before air reaches the outer atmosphere it affects people who are in the direction of the wind. The private costs of pollution are low enough that the individual is willing to accept it. Private costs may also be lower than the costs to the rest of society Arthur Busch underscores this point by emphasizing that pollution places the rights of individuals against the public welfare.

A second important factor encouraging damage to the ecosystem is the economic pricing system. Industrial expansion was justified on the grounds that the spillover effects were outweighed by the good that was being produced. Industry used externalities to keep costs down since it was cheaper to pollute than to clean up.

Today, the costs of pollution are extremely hard to define. In his presentation, Joseph Fisher, President of Resources for the Future, pointed out that many causes of pollution are subjective and that damages incurred generally take place years later or miles away from the original source. The central issue is that no market mechanisms exist to register dollar values for environmental deterioration. In analyzing this point further, Marshall Goldman discusses the pricing of environmental quality. In the market system, prices affect demands for the product and demands affect prices. If the pricing system is to function adequately, the costs of all inputs used in the production processes must be properly identified. Yet how can we identify and price environmental consequences, both the overuse of natural resources and the eventual waste discharge resulting after consumption is completed? What is the dollar value of clean air or dirty water?

A major issue today is who is going to pay for pollution abatement. In the absence of more sophisticated cost procedures, prevention and abatement costs will need to be paid. Mr. Fisher argues that the solution lies in complete subsidization by the government. He notes that we are currently spending one percent of the Gross National Product (approximately $12 billion) on pollution abatement. By doubling or tripling this rate and sustaining the level of funding (thus, $24 billion or $36 billion), he believed that the trend of increasing pollution could be reversed. An opposite view was expressed by Mr. Busch. Since unlimited funding from public sources is unlikely, the producers and consumers will need to bear the costs for environmental improvement. He states that pollution abatement is one of the costs of doing business. While profits are still necessary, the consequences that have been levied on the environment are no longer acceptable.

A third and final factor which contributes to the deterioration of some ecosystems is our commitment to growth. Historically, our country has been enamored with growth statistics such as the GNP, new housing starts, or number of cars produced. Rarely have our statistics been able to incorporate aesthetic values or the quality of life since few indicators or measures exist. Today, many social scientists have begun to question the concept of growth and posit the idea that our society consider other alternatives such as managed growth or no growth. During his presentation, Ian McHarg described the social-economic policies which could be followed under alternative growth models. If we continue to pursue an uncontrolled growth rate, we will accommodate the maximum social damage at the greatest social cost for the least possible social benefit. A more conscientious policy would be to develop the maximum social benefit at the least social cost and proceed to allocate growth according to gratification of the largest number of people. Critics of managed or no growth stress the following: (a) limited growth may lower material living standards; (b) conservation of materials would take place if substitute materials were found or prices were increased in order to finance social programs; (c) growth is necessary; and (d) an adequate permit system for discharging into the ecosystem can be developed. On the other hand, proponents have argued that a lowering of the material standard of living may result in a higher quality of life since environmental improvements would be made. In the past, growth has not led to the solution of social problems; and the economy has failed to assure or protect the environment. It is not possible to discuss these conflicts in detail here. However, the issue of growth is addressed in the latter part of this chapter, as well as in subsequent chapters.

In summary, this discussion focused on the relationship between environmental quality as a policy goal and various aspects of economic policy. The complexity of environmental policy and its interrelationship with our social concerns should be evident. Blair Bower offers some tempered observations:

> "Decisions and choices within the environmental sector are linked to decisions and choices in other sectors of the economy. Just as there are limited environmental resources, so there are limited human and capital rsources."

VIEWS AND PERSPECTIVES ON THE ENVIRONMENT

Just as there are many policies that directly affect environmental quality, there are many perceptions of the nature of environmental problems and potential solutions. If environmental managers are going to be effective, they must be aware of these views.

Charles Henry, City Manager, University City, Missouri, defines the "environment" as referring to "everything around us." The city administrator in his daily activities must define the concept broadly, due to the complex interrelatedness of problems and programs in the urban environment. John Wentz, City Manager, Phoenix, Arizona, points out that managers should, for the moment, restrict their definition to physical, visual, sensory aspects of the environment. They must resist the temptation to define the environment in terms of life style, a concept of too much complexity for the development of environmental programs.

Although Mr. Henry defines the environment in broad terms, the city administrator, as guardian of the municipal environment, has limited tools available for improving environmental quality. Primary sources of control are vested in city codes (e.g., building and sanitation codes, private landscaping and sign control). The administrator must be able to secure local code compliance by bringing violations into a local court. Through the courts, everyday occurrences such as litter and sanitation violations can be processed and remedied. On the other hand, Mayor Stephen May of Rochester, New York, sees a wider range of environmental action for local governments. As an urban administrator, he must deliver basic services such as garbage removal, code enforcement, and rodent control. In addition, he is presently faced with the need to retain industries presently located in Rochester, as well as to attract new industry to maintain sufficient employment in his community. To accomplish these objectives in environmentally sound ways, Mayor May has been working with industry on some specific issues, particularly the screening of parking lots to reduce visual pollution and a new in-town community to promote balanced development. He believes that those in government must be sensitized to environmental needs and that a balance be struck between the need for jobs and industrial expansion, and the need for a decent environment. While the vigilance over the environment must be continued, the demands for growth must sometimes be accommodated at the same time.

Shelly Mark (II. 7), Director of the State of Hawaii Department of Planning and Economic Development, relates the steps taken by Hawaii to define and enact a limited growth policy. He discusses the terms "quality growth" as opposed to "quantity growth," which he equates with the concepts of limited growth and increased growth. Dr. Mark points out that efforts toward achieving a quality growth pattern must be multidimensional, since a socially desirable balance among economic, social and environmental elements needs to be achieved. To direct any kind of growth policy, several steps are identified: (1) a consensus should be reached on the objectives in planning quality growth, (2) the rates and kinds of growth patterns must be under control, and (3) knowledge must exist in order to predict the effects of certain actions. A further elaboration of Dr. Mark's ideas can be found in the latter part of this chapter.

CORPORATE OFFICIALS SEEK PRIORITIES, SOLUTIONS

The views of business and industry are important in achieving a comprehensive picture of environmental problems. Many representatives of industry readily point to their own programs for pollution abatement. During his presentation at the Conference, Edwin Nelson of General Motors Corporation identified several essential ingredients for industry to be successful in the pursuit of a better environment: (1) management priorities must be determined, (2) the problems need to be idntified, and (3) sound, technically feasible solutions must be developed. He summarized some of the steps taken by General Motors in environmental management. In February, 1971, General Motors Corp. created an environmental activities staff to operate within the corporate structure. Their primary functions are communicating with regulatory agencies, providing technical information to local, state and federal governmental bodies, and establishing environmental control programs that will ensure the best balance between cost and benefit to society. In addition, GM is carrying on large research programs on the environment. One example is the extensive research on alternative power sources to the internal combustion engine. However, since these alternatives will not be viable in the near future, the company is making a concentrated effort to modify and refine present engines and emission control systems, particularly the catalytic converter. Another example of their research activities is in the evaluation of differing processes for removing sulfur dioxide from coal. One of these processes is a regenerative double alkali sulfur dioxide pilot study which would determine if the caustic could be regenerated and used back in the system. If successful, this program would be a significant development in reaching short-term solutions to the energy problem.

Although continued research is essential in finding alternatives for controlling pollution, industry may broaden its scope of environmental protection by seeking and creating new markets for environmental improvements. Arthur Busch argues that environmental improvement could become a giant industry, increasing in importance as new technology develops. The possibilities in developing untapped markets for environmental improvements exist within the private sector. James Brian Quinn outlines how industry and the environment can profit from one another. One means is to transfer what private enterprise has developed to satisfy consumer demands to developing and filling demands for public consumption and investment such as sewage systems, water supplies, parks and airports. If public markets could be developed by private companies, growth opportunities for industry would occur while many socio-economic problems could be improved.

Mr. Quinn also sees potential markets in properly administered government regulations and standards. An example would be the stringent radioactive emission and waste disposal standards which, if met, would increase confidence in atomic power plants and expand their markets. Eventually, proper regulation could elicit new primary markets, contributing to national growth in much the same way as a new product contributes to economic growth. Nevertheless, the shift to a market economy, with heavy emphasis on environmental improvement, will not be without serious costs to individual companies and communities. The problem should be temporary and could be relieved by elongating the impact of change, providing temporary tax relief, or working with communities that have lost industries. Ultimately, the supports would be dropped and the impact of choices would be distributed through industry by means of pricing decisions.

The views presented in this section are not all-inclusive, but rather provide a sample from both government and industry. It is hoped that environmental managers will become familiar with the views and particular circumstances in their own communities.

ENVIRONMENTAL DECISION-MAKING

Assuming that an environmental manager has information regarding the environment and is apprised of the views in his community, the decision-making process is highly important in relation to improving environmental quality. The environmental manager might consider a variety of approaches to choose from among competing policy alternatives, ranging from an incremental approach to a rational-systematic approach. During his presentation, Charles Lindblom, Professor, Yale University, argued that the only realistic approach is incrementalism. The incremental approach to decision making is characterized by focused attacks on specific problems, thus restricting the number of alternatives and policies to those that differ only incrementally from existing policies. He comments:

> "Since everything is connected, it is beyond our capacity to manipulate everything altogether. Comprehensive plans and broad goals would make a lot more sense if things were not so interconnected. Then, you could factor out a piece of society and deal with it. Since everything is interconnected, the whole social world, or the whole of the environment problem, is way beyond our capacity. We have to find

> critical points of intervention, tactically defensible, or strategically defensible points of intervention."

Support for the incremental approach in action is provided by Phoenix City Manager John Wentz who suggests that environmental decision-making must be realistic. His formula for achieving practical decision-making is to make highly focused attacks such as controlling sporadic development by zoning or cutting down on visual pollution through sign control. Mr. Wentz indicates that short-term actions and the winning of small victories make it easier to address more complex and comprehensive problems in the longer term.

A different decision-making approach was presented by J. L. McClintock of Weyerhauser Corporation in his description of the environmental impact of a pulp and paper mill. In order to reduce the B.O.D. (Biochemical Oxygen Demand) discharged from the mills, several alternatives can be developed from which one or two could be selected that result in the least adverse consequences. Through a systematic process, alternatives are examined and evaluated based upon the ability to achieve a viable plan for environmental protection. Then, the decision is made by selecting the best alternative. However, this use of more rational decision-making is hampered by the lack of knowledge regarding the ecosystem and the large amount of time consumed in conducting the analysis.

A COMPLEX ENVIRONMENTAL MANAGEMENT MILIEU

As noted in the introduction to chapter one, the environmental manager is faced with a complex political, technical and administrative milieu which makes it difficult to make comprehensive decisions. Decisions may be stimulated or constrained by: ecological considerations, environmental crises, political pressures, unproven management strategies, administrative dilemmas, technical considerations, and governmental requirements. If managers recognize these potential forces and constraints, their ability to deal with the environment in a comprehensive way will be enhanced.

This chapter has analyzed some of the important points regarding the environment as a policy issue. No claim is made that the ideas mentioned are comprehensive, but rather they reflect the concerns of conference participants. Several major themes emerged from the panels and workshops. First, we do not possess sufficient knowledge on indicators of environmental quality. Second, many of our assumptions regarding growth need to be re-evaluated in light of the desire for better environmental quality. Finally, environmental decision-makers need to relate environmental problems to other policy areas while developing an environmental management program for specific environmental problems.

Notes for Chapter II

[1] Eugene P. Odum, *Ecology*. New York: Holt, Rinehart and Winston, 1963.

[2] Eugene P. Odum, "The Strategy of Ecosystem Development," *Science* CLXIV (18 April 1969), p. 262, (2b) pp. 262-270, (2c), p. 262, (2d), p. 269, (2e), p. 269.

[3] Louis J. Battan, *The Unclean Sky*: (Garden City, N.Y. Anchor Books, 1966), pp. 103-104.

II.1 The economics of ecology

Kenneth E. Boulding *

It is no accident that the words "ecology" and "economics" both come from the same Greek root meaning "household." They both deal indeed with the housekeeping of the earth, and the economic system can be regarded as a special case of the ecological system of the planet, dealing mainly with the ecology of human artifacts and human behavior.

An ecological system is essentially a system of interacting species, a species being any set of elements, each of which conforms to a common definition, the total number of which is a population which can be added to by the formation of new elements (births or production) and can be subtracted from by the disappearance of old elements (death or consumption). In most populations each element can be identified by its age, that is, the period of time that has elapsed since it was born, and this is frequently an important characteristic of the system though this information is not necessary for the definition of a population or a species.

In biological ecosystems the species and the populations consist of living organisms. The definition of a species is not always clear, although the usual definition is based on reproductive ability, that is, a species consists of elements which can reproduce themselves. Other quantities which are not usually thought of as biological species, however, may be significant, such as the chemical species in the soil, the atmosphere, or the waters, and also variables which are a little hard to put under the general rubric of population, such as temperature, time patterns, annual distribution of rainfall, and so on.

Automobiles as a species

Economic species consist mainly of commodities; for instance, automobiles and their subspecies such as Chevrolets, Volkswagens, and so on. Social species include human artifacts of all kinds, including human beings themselves, as well as their genetic characteristics, their education, skills, capacities, and so on, which also are human artifacts in a large degree. We should also include social organizations among social species—families, corporations, churches, states, counties, government agencies, voluntary agencies, and so on.

The dynamic process of any ecosystem depends on the relationship between the births and the deaths for any one population, and all other elements of the system, especially the size of all the other populations. If from the state of the system at any one time we can deduce the number of births and deaths in each population in the next period, we know how large all the populations will be at the end of the next period, and hence can go on projecting for successive periods. If births exceed deaths, the population will grow; if deaths exceed births, it will decline; if it declines to the point where the population is zero, it becomes extinct unless it can be re-formed, which is very unlikely. An ecosystem may have an equilibrium position, in which the state of the system is such that the births equal the deaths for all populations.

Equilibrium is imperfect

Equilibrium in a literal sense is virtually unknown in the real world, but there are approximations of equilibrium; for instance, in a climatic ecosystem of a forest or a pond, or a hypothetical stationary state in a society. Because it is difficult to visualize an absolutely continuous disequilibrium

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*Presented by Kenneth E. Boulding, Professor of Economics, University of Colorado. Invited paper delivered at the National Conference on Managing the Environment, session on: The Environment: How Comprehensive?

process (which is what the world is), it is often useful to think in terms of a succession of equilibrium states, even though this is only approximated in nature. Thus, a mutation is a change in the functions which relate births and deaths to the other states of the system, or it may represent a change in the state of the system through the introduction of a new species. This will almost invariably produce a new potential equilibrium, in which some species may disappear and the new species may either survive or may also disappear. This is the essence indeed of the process of evolution, whether in biological or in social systems. Selection is always the selection of ecosystems, never the selection of species.

A species survives if it has a place or a niche in an ecosystem which survives. The niche of the species is that population, under given conditions in the state of the system, at which the births and deaths are equal so that the population is stable. Ordinarily for populations smaller than this, births will exceed deaths; for populations larger than this, deaths will exceed births, in which case the niche population is a true equilibrium. The niche may be a physical niche, like a cave or a coral reef, or it may not. It may simply be bounded by the pressures of other species.

An important feature of any ecosystem is its system of inputs and outputs. Every biological population requires inputs of food and produces outputs, or excretions. We should include in this the gaseous "foods" and excretions, such as oxygen and carbon dioxide. The inputs and outputs have two aspects—a materials aspect and an energy aspect. A species has to be able to draw more materials from the environment than it excretes if it is to grow. Similarly, every species needs energy if it is to operate and move. If an ecosystem is to survive for very long, it must have a cycle of materials and a source of energy. The nitrogen cycle is a famous example of the first, and, of course, almost all of the biosphere depends on the input of solar energy to prevent its running down.

The man-made ecosystem

Man and his artifacts must be regarded as part of the ecosystem, and it makes very little sense to separate the non-human part of the ecosystem from the human part. The automobile is just as much a species as the horse, though its genetics is more complicated. It has an input of materials, mostly from mines; it has an output of materials into dumps; it feeds on gasoline and excretes water, carbon dioxide, carbon monoxide, nitrous oxide and so on; and it survives because it has a niche. That is, there is some population of automobiles in which births equal deaths in any given environment, just like the horse.

There are three basic types of relationships among species: mutual competition, mutual cooperation, and predation. All of these are important. Predation is inherently the more stable of the three.

The evolution of man has produced profound changes in the ecosystem of the world, mainly because the human nervous system has a very much greater capacity for knowledge, that is, for building structures in the internal systems which correspond to the structures in the external system, than any other species. As a result, man is unusually cooperative ecologically with his own artifacts, which can be thought of as a peculiar kind of excretion of human activtiy. Most living species produce only manure, which is often directly competitive with them, although perhaps indirectly cooperative through its role in the materials cycle. Human beings produce corn, wheat, machines, automobiles, clothing, and so on. These artifacts have resulted in an almost continual expansion of the human niche. There have been times indeed when man has pressed against his existing niche, but this pressure has often resulted in technological improvements, such as agriculture or metallurgy, which have expanded the niche and enabled continuing growth of the human population.

Economic habitat

The economic system is a subset of the total social system, and therefore of the total ecological system, which deals particularly with those human artifacts, skills, and services which are exchanged or which are potentially exchangeable. Every person, family or organization of the social system lives in an exchange environment. Each unit specializes in the production of a limited set of artifacts or services. (Services are simply artifacts—songs, communications ,orders, and so on—which have a very short length of life.) He may exchange these directly for other artifacts and services through barter, but as social organization develops some artifact (cattle, metal, cigarettes) becomes generally acceptable in exchange and begins to play the role of money. Money is a general medium of exchange which is accepted not for its own sake but because somebody else will accept it in return for other things. Eventually money becomes divorced from its commodity base altogether and becomes a simple abstract unit of account, like the bank deposit. Even in this form, it still represents a "population;" dollars are born and die, migrate in and out of particular regions just like any other population. If I am adding to my money stock faster than I am spending it or diminishing it, it will grow.

In a developed society barter is a miniscule part of the total volume of exchanges. Most people or economic units have an input of money which they derive from either the sale of some goods or services that they have produced—the wheat of the wheat farmer, or the services of the wage worker—or from "grants," that is, one-way transfers in the form of gifts, tribute, or taxes. They spend out of their money stock for all the various goods and services that they want and can afford. Thus, every social organization has a throughput of money which is not wholly unlike the throughput of nitrogen in the biological nitrogen cycle, and because of this we are able to organize an enormous variety of organizations and artifacts.

Every organization or sector is significantly affected by its "terms of trade," that is, the ratio of the *real* goods and services it takes in to the goods and services that it gives out, so that our terms of trade "improve" if we can take in more per unit of what we give out. The structure of terms of trade depends on the total relative price structure. Thus, if the price of wheat rises while that of other things does not, the terms of trade of the wheat farmer improve; he can get more other things per bushel of wheat.

The economic system has had a very substantial impact on the total ecological system of the planet, mainly because humans act to increase those populations in the total environment which they perceive as cooperative with them and act to diminish those which they perceive as competitive. This introduces a very significant selective factor in the whole ecosystem, producing grain and potatoes instead of bramble bushes, cows instead of buffalo, automobiles instead of horses, buildings instead of open fields, and so on.

Expanding human dominion

Because the human race has found no really satisfactory social mechanism for population control up to date (except in a few cases in simple societies, which have all turned out to be unstable in the long run), human activities have been profoundly dominated by niche-increasing activity. This inevitably has put pressure on other species, especially those which humans perceive as competitive with them, or niche-limiting, such as the lion and the bear, the mosquito and the insect pests, the disease bacillus, and horse manure.

A fundamental problem arises, however, because virtually all human activity produces both goods and "bads," both things which are perceived as enhancing human life and those which are perceived as detracting from it. This is why we have pollution—not because there are wicked people who like to pollute things (this is a very minor element in the problem), but because if we want beef, we have to have polluting feedlots, if we want electric power, we have to have polluting power stations, and so on. A critical problem in the economy is how to make private decisions for private benefit also produce public benefits. We have to create Adam Smith's "invisible hand," which makes private and public benefits the same. There are particular difficulties here in the case of "public goods" and "public bads," which cannot be privately appropriated and can only be organized through a public political process. Otherwise, we get what Garrett Hardin has called the "tragedy of the commons," and the "invisible hand" then steals out of all our pockets. Many things which ecologists worry about, such as wilderness or the preservation of species, fall under the category of "public goods" which cannot be provided through private markets.

How many is too many?

A very critical question is whether the human race is now approaching its ultimate niche. Can we go on expanding without ecological disaster? Is the human race just a fire weed that expanded because of a dynamic process which cannot be sustained? It is certainly possible to conceive of a sustainable high-level economy, but we are still a long way from the technology which can achieve this.

Today, ecology rather than economics seems to be taking on the role of the dismal science. All the dismal theorems, however, merely amount to saying that there are limitations. If these limitations are recognized and accepted, and organized action is directed towards them, there is no reason why they should be fatal. If we have, in fact, exceeded the human carrying capacity of the earth (and it is by no means clear that this is so), we will certainly have a rough time getting back to that capacity. There seems to be no inherent reason, however, why, once it has been achieved, a "spaceship earth" should not be both stable and reasonably agreeable.

II.2 The nature and behavior of ecological systems

C. S. Holling and
M. A. Goldberg *

Rather than presenting an exhaustive treatment of ecological concepts and terms, we hope to apply the philosophy of the ecological approach to solve problems of a kind that recur in all complex systems.[1] The key insight of this approach is that ecological systems are not in a state of delicate balance. Long before man appeared on the scene, natural systems were subjected to traumas and shocks imposed by climatic changes and other geophysical processes. The ecological systems that have survived have been those that are able to absorb and adapt to these traumas. As a result, these systems have considerable internal resilience, but we know that this resilience is not infinite. A forest can be turned into a desert, as in the Middle East, or a lake into the aquatic analog of a desert. The key feature of the resilience of ecological systems is that incremental changes are absorbed. It is only when a series of incremental changes accumulate or a massive shock is imposed, that the resilience of the system is exceeded, generating dramatic and unexpected signals of change.

This has considerable consequence for planning since, inherent in the philosophy of planning and intervention, is the presumption that an incremental change will quickly generate a signal of whether the intervention is correct or not. If the signal indicates the intervention produces higher costs than benefits, then a new policy and a new incremental change can be developed. But because of the resilience of ecological systems, incremental changes do not generate immediate signals of their effect. As a result, planners can set in motion a sequence of incremental steps and face the reality of the inadequacy of the underlying policy only when the interventions accumulate to shatter the bounds of resilience within the system. By that time it can be too late. In order to demonstrate these features of ecosystems we will discuss one specific case hisory, based on man's intervention. The consequences of the intervention reveal some of the key properties of ecosystems.

Malarial control in Borneo

Since the Second World War, the World Health Organization (WHO) has developed a remarkably successful malarial eradication program throughout the world. We wish to emphasize that, in this example of intervention, there is no question that there has been a dramatic improvement in the quality of life of people in affected regions. But, we wish to explore a specific case in which the World Health Organization sprayed village huts in Borneo with DDT in order to kill the mosquito that carries the pasmodium of malaria. This case has been documented by Harrison (1965).

The inland Dayak people of Borneo live in large single homes or long houses with up to 500 or more under one roof. This concentration of population allowed WHO to develop a thorough and orderly spraying of every long house, hut, and human habitation with DDT. The effect on health standards was dramatic with a remarkable improvement in the energy and vitality of the people—particularly those remote tribes who had not previously had

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access to medical aid. Nevertheless, there were interesting consequences that illuminate some of the properties of ecological systems.

There is a small community of organisms that occupy the thatched huts of these villages—cats, cockroaches, and small lizards. The cockroaches picked up the DDT and were subsequently eaten by the lizards. In consuming the cockroaches, the lizards concentrated the DDT to a somewhat higher level than was present in the cockroaches. The cats ate the lizards and, by eating them, concentrated the level of DDT still further—to the point that it became lethal. The cats died. When the cats disappeared from the villages, woodland rats invaded, and it suddenly became apparent that the cats had been performing a hidden function—controlling rat populations. Now, with the rat came a new complex of organisms—fleas, lice, and parasites, and this community presented a new public health hazard of sylvatic plague. The problem became serious enough that finally the RAF was called to parachute living cats into these isolated villages in order to control the rats.

DDT brought the house down

The story isn't finished at this point, however, since the DDT also killed the parasites and predators of a small caterpillar that normally causes minor damage to thatch roofs (Cheng 1963). The caterpillar populations, now uncontrolled, increased dramatically, causing the roofs of the huts to collapse.

We cite this example not because it has great substance, but simply because it shows the variety of interactive pathways that link parts of an ecological system, pathways that are sufficiently intricate and complicated so that manipulating one fragment causes a reverberation throughout the system. In addition, this case provides a simple example of a food chain in which energy and material moves from cockroaches to lizards to cats. Typically, in these food chains the number of organisms at a higher level in the chain are less abundant than those lower in the chain. This is the inevitable result of the loss of energy in moving from one trophic and nutritional level to another, and the consequence is a biological amplification that concentrates certain material at higher and higher levels as one moves up the chain. A contaminant like DDT, for example, can be present in the environment in very low, innocuous levels but can reach serious concentrations after two or three steps in the food chain. Actually, this example is highly simplified; usually in such situations there is a food *web* rather than a single linear food chain. Several species operate at more than one trophic level. Moreover, there are competitive interactions that further complicate and link species within an ecosystem. Even in this example, however, it is clear that the whole is not a simple sum of the parts and that there are a large number of components in a system acting and interacting in a variety of complex ways.

Nature of ecological systems

This example illuminates four essential properties of ecological systems. By encompassing many components with complex feedback interactions between them, they exhibit a systems property. By responding not just to present events but to past ones as well, they show a *historical* quality. By responding to events at more than one point in space, they show a spatial interlocking property, and through the appearance of lags, thresholds, and limits they present distinctive *non-linear* structural properties. First, ecosystems are characterized not only by their parts but also by the interaction among these parts. It is because of the complexity of the interactions that it is so dangerous to take a fragmented view, to look at an isolated piece of the system. By concentrating on one fragment and trying to optimize the performance of that fragment, we find that the rest of the system responds in unsuspected ways.

Second, ecological systems have not been assembled out of preexisting parts like a machine: they have evolved in time and are defined in part by their history. This point does not emerge clearly from the example quoted; nevertheless, the resilience described in the example is very much the consequence of past history.

When a large area is stripped of vegetation, a historical process begins that leads to the evolution of a stable ecosystem through a series of successional stages. Early in this succession, pioneer species occupy the space, and the diversity and complexity are low. The species that can operate under these circumstances are highly resistant to extreme conditions of drought and temperature and are highly productive. Competition is low, and a large proportion of the incident solar energy is converted to the production of bio-mass (the standing stock of organic material). As this accumulates, the conditions of the area begin to improve and permit the appearance of groups of plants and animals that otherwise could not survive. The result is a gradual increase in the variety of species and in the complexity of interaction, and this increase in complexity is accompanied by an increase in the resilience of the system and a decrease in productivity. Under stable conditions this successional history can continue until a stable climax ecosystem evolves.

Agriculture: simplifying nature

Man's objective in agricultural management is to halt this history at an early successional stage when the productivity is high. The price of doing this is a continual effort to prevent the system from moving to its more stable and less productive stage: hence herbicides and cultural practices eliminate or reduce those organisms that compete with man for food. But by emphasizing high productivity as a narrow objective, man develops the simplest and most direct policy, and the result leads to decreased complexity—large monocultures, heavy use of chemical herbicides, insecticides, and fertilizers. For the short term, the narrow objective of increased productivity is achieved, but the price paid is a dramatic decline in the resilience of the system. Third, complex ecosystems have very significant spatial interactions. Just as they have been formed by events over time so they are affected by events over space. Ecosystems are not homogeneous structures but present a spatial mosaic of biological and physical characteristics.

Finally, there are a variety of structural properties of the processes that interrelate the components of an ecosystem. We do not wish to dwell on these details other than to say they present singular problems in mathematical analysis for they relate to the existence of thresholds, lags, limits, and discontinuities.

Behavior of ecosystems

The distinctive behavior of systems flows from these four properties. Together they produce both resilience and stability. Even simple systems have properties of stability. Consider the example discussed by Hardin (1963). Every warmblooded animal regulates its temperature. In man the temperature is close to 98.6°F. If through sickness or through dramatic change in external temperature, the body temperature begins to rise or fall, then negative feedback processes bring the temperature back to the equilibrium level. But we note this regulation occurs only within limits. If the body temperature is forced too high—above 106°F., the excessive heat input defeats the regulation. The higher temperature increases metabolism which produces more heat, which produces higher temperature, and so on. The result is death. The same happens if temperature drops below a critical boundary. We see, therefore, even in this simple system, that stability relates not just to he equilibrium point but to the domain of temperatures over which true temperature regulation can occur. It is this domain of stability that is the measure of resilience.

In a more complex system, there are many quantities and qualities that change. Each species in an ecosystem and each qualitatively different individual within a species are distinct dimensions that can change over time. If we monitor the change in the quantity or quality of one of these dimensions, we can envisage results of the kind shown in Figure 1. Within the range of stable equilibrium, if we cause a change in the quantity being measured, it will return to equilibrium over time. But there is a limit to which we can perturb these quantities, and that limit is defined as a boundary of stability.

Ecological instability

The domain of stability is contained within the upper and lower boundaries. In simple physiological and engineering control feedback systems, regulation is strong enough and conditions are stable enough that most of our attention can be fixed on or near the equilibrium. This is not true of ecological systems (Holling and Ewing 1969). Ecological systems exist in a highly variable physical environment so that the equilibrium point itself is continually shifting and changing over time. At any one moment, each dimension of the system is attempting to track the equilibrium point but rarely, if ever, is achieved. Because of this variability imposed upon ecological systems, the ones that have survived, the ones that have not exceeded the boundaries of stability, are those that have evolved tactics to keep the domain of stability, or resilience, broad enough to absorb the consequences of change. The regulation forces within the domain of stability tend to be weak until the system approaches the boundary. They are not efficient systems in an optimizing sense because the price paid for efficiency is a decreased resilience and a high probability of extinction.

This view of stability is, of course, highly simplified. There may not be just one stable equilibrium at any instantaneous point in time: there may be several. Moreover, the stable condition might not be a single value but a sequence of values that return to a common starting value. This stable condition is termed a *stable limit cycle* (Figure 2). Finally, the sequence of stable values need never return to some common starting point. The earlier description of an ecological succession really represents such a condition—a *stable trajectory* as illustrated in Figure 3.

But, however the equilibrium conditions change, they are all bounded, and what we must ask in judging any policy is not only how effectively an equilibrium is achieved, but also how the resilience, or the domain of stability, is changed. The two insecticide examples illustrate the point. The policies used in these cases were characterized by three conditions:

1. The problem is first isolated from the whole; that is, pests are damaging cotton.
2. The objective is defined narrowly: that is, kill the insect pest.
3. The simplest and most direct intervention is selected; that is broad-scale application of a highly toxic long-lived insecticide.

Each of these conditions assumes unlimited resilience in the system. By adopting these policies, the problem and the solution are made simple enough to be highly successful in the short term. So long as there is sufficient resilience to absorb the consequencse of our ignorance, then the success can persist for a very long time. It is successful in the sense that the agriculturist can return his system almost instantly to an equilibrium point of one crop and no competing pests. The price paid, however, is the contraction of the boundaries of stability, and an equilibrium-centered point of view can be disastrous from a boundary-oriented view.

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[1] The notion of incremental (or "marginal" in the economist's jargon) changes is part and parcel of cost-benefit analysis. Non-marginal investments, which can change the structure of prices and the allocation of resources, are difficult to deal with under present cost-benefit approaches. Thus, resilience is usually assumed by ignoring changes in prices induced by large-scale projects. See Prest and Turvey (1965) for a discussion of the assumptions concerning marginal and non-marginal projects.

FIGURE 1.—AN EXAMPLE OF A SYSTEM WITH A STABLE EQUILIBRIUM IN WHICH STABILITY IS POSSIBLE WITHIN DISTINCT BOUNDARIES

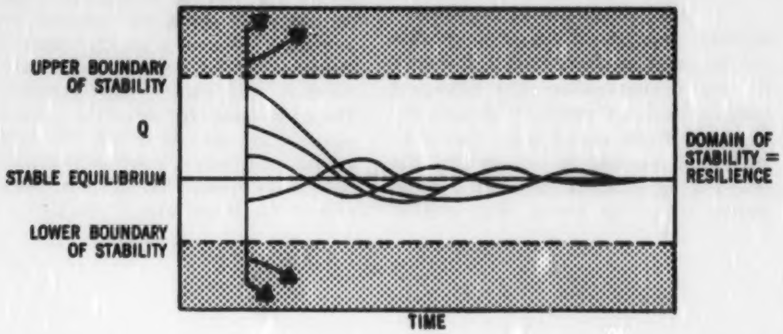

UPPER BOUNDARY OF STABILITY
Q
STABLE EQUILIBRIUM
LOWER BOUNDARY OF STABILITY
DOMAIN OF STABILITY = RESILIENCE
TIME

FIGURE 2.—AN EXAMPLE OF A BOUNDED LIMIT CYCLE, HOLLING & GOLDBERG

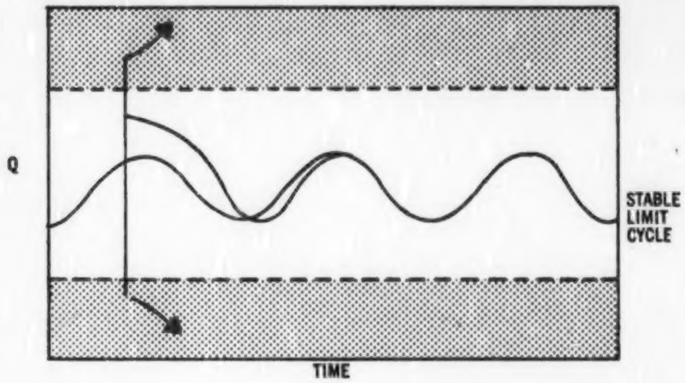
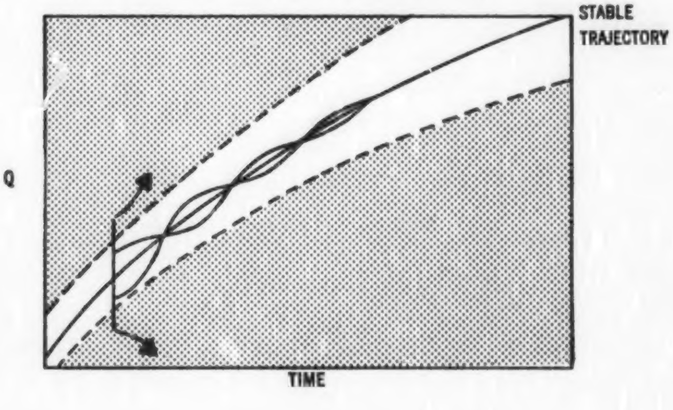

Q
STABLE LIMIT CYCLE
TIME

FIGURE 3.—AN EXAMPLE OF A BOUNDED STABLE TRAJECTORY ANALOGOUS TO THAT FOUND IN AN ECOLOGICAL SUCCESSION


STABLE TRAJECTORY
Q
TIME

Minimizing chances of disaster

It is this boundary-oriented view of stability emerging from ecology that can serve as a conceptual framework for man's intervention into ecological systems. Such a framework changes the emphasis from maximizing the probability of success to minimizing the change of disaster. It shifts the concentration from the forces that lead to convergence on equilibrium, to the forces that lead to divergence from a boundary. It shifts our interest from increased efficiency to the need for resilience. Most important, it focuses attention on causes, not symptoms. There is now, for example, growing concern for pollution, but the causes are not just the *explosion* of population and consumption, but also the *implosion* of the boundaries of stability.

II.3 Pollution: the mess around us

Marshall I. Goldman *

Pollution has plagued mankind for centuries, and we all know what it is. But the word itself is often used to cover a variety of sins. Before we can talk intelligently about it, we should try to define what we mean. Actually, what we have had is environmental disruption. There is virtually no naturally pure water and air and most of us would not know what to do with pure air and water if we had it. Pure oxygen, if that is what we mean by pure air, would make us giddy, and pure distilled water would have no taste.

Even if pure air and water had existed at one time in a natural state, the mere presence of human beings and animals would be enough to alter those conditions. Such changes, however, are not serious unless they radically disrupt the existing balance or make the environment unfit for other organisms. Even then, it is necessary to distinguish between *impurities*, which make water and air economically or aesthetically undesirable—and may also destroy some forms of flora or fauna—and *contaminating* substances, which endanger the health of human beings.

That undesired changes were taking place in the water supply was recognized by the Romans before the first century B.C. Because the sewage generated by a city of about one million people endangered the drinking water, the Romans built one of the first major municipal sewers in history, the Cloaca Maxima. Venice, after all, was and is nothing but a sewer in search of a city. Until new construction recently disrupted the age-old water circulation pattern, the city flushed its sewage effortlessly into the sea twice a day by using the natural flow of the tides. In the north, Richard II of England as early as 1388 banned the throwing of filth into the Thames. Later generations, however, were ignorant of such necessities and dumped their sewage whenever and wherever convenient. The result was dysentery and periodic epidemics of such diseases as cholera and typhoid.

Centuries of smog

Smog has also annoyed man for centuries. Although smog in Los Angeles did not become a burning issue until 1943, in the mid-sixteenth century Spanish explorers landing there noted layers of smoke from Indian fires hanging above the area. In the scientific terminology of today this is called an inversion layer. For centuries England has been similarly plagued by polluted air. As early as the thirteenth century English authorities complained about smoke from coal and charcoal fires. By the fourteenth century the first clean air legislation had been passed, and one man was actually hanged in London for violating the law. Apparently such laws later fell into disuse. This is indicated in an appeal addressed to Charles II in 1661 by John Evelyn, entitled "*Fumifugium or the Inconvenience of the Aer and Smoake of London. Dissipated Together with some Remedies humbly proposed by John Evelyn Esq: To His Sacred Majestie and To the Parliament now Assembled. Published by His Majesty's Command.*" Charles Dickens' England continued to suffer from sunless skies and smoky moors. Ironically, the English government during World War II encouraged smoke emission in order to obscure bombing targets from the Germans.

Still, despite isolated examples, until the beginning of the twentieth century man has been able to coexist with his waste. There was little or no interference with nature's self-regenerating system. Generally harmonious proportions were kept among such living organisms as human beings, vegetation, and animals. Moreover, since there had been little experimentation with the earth's minerals, almost all waste decomposed rapidly or served as nutrient or raw material for other forms of life. For example, kitchen garbage was nicely disposed of by the livestock usually kept for human consumption. The circle seemed to be perfect.

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By the late nineteenth century, however, the careful observer could find some disproportion in the circle. Pollution, which for centuries had not been especially offensive, gradually became intolerable in a growing number of places. In the years following World War II there was no longer any doubt that the circle had popped and left gaping holes out of which an increasingly alarmed population gasped for fresh air and water.

An annoyance becomes a crisis

In this country the emergence of concern about environmental disruption has been caused by a combination of developments such as (1) population explosion, (2) unparalleled affluence, (3) technological progress, and (4) major incidents affecting the health and well-being of large numbers of people.

1. Since World War II the world's population has been expanding at an exceptionally rapid rate. Paul Ehrlich of Stanford University points out that world population doubled during the two hundred years between 1650 and 1850. The next doubling took eighty years, and now it takes only thirty-five years. Moreover, it is not just that there are more of us, but that we are clustered in ever more compact areas. Kingsley Davis estimates that 40 percent of the world's population live in urban areas; 50 percent or urban dwellers live in cities of 100,000 or more. Naturally the more people there are, the more wastes there are to recycle. The concentration of people and their accompanying wastes makes the task of recycling and disposal all the more difficult. In the past, water, air, and solid wastes were discharged in small, easily diluted doses; now wastes are collected in large sewage complexes, tall chimney stacks, or sprawling dumps that are invariably overtaxed. The same disposal problem was created when livestock was taken from wide-open ranges and farmlands and herded into feed lots. Although once manure served as the main source of fertilizer, now much of it has become a mess to be disposed of as expeditiously and odorlessly as possible. Chemical fertilizer now accomplishes artificially what used to be done naturally.

To escape the crushing throngs in the cities, people formed a mass exodus to the suburbs. Large numbers of people apparently decided that they did not like being crowded together in the city; if they were going to be crowded, they decided that it was much better to crowd together in the suburbs. Green spaces began to disappear; before long airplane pilots and geographers found themselves unable to distinguish where one town ended and another began. Vast portions of the countryside from New Hampshire to Virginia became one continuous suburb, which Jean Gottman called "Megalopolis." This term may also come to describe the area from Los Angeles to San Francisco and from Chicago to Detroit or from Chicago to Pittsburgh.

As the population grew and increased its mobility and its discharge of refuse, natural facilities for transforming waste began to disappear. Factories and stores moved outside of the cities, brought with them highways, asphalt parking lots, and demands for water and air. To the regular wastes of consumption and production in the cities were added the remains of buildings demolished under urban renewal programs. In many areas it became harder and harder to find natural preserves in which to process or absorb smoke and liquid and solid wastes.

Filthy lucre

2. The population has grown not

only in size but also in wealth. With per capita income reaching historic heights, production has risen to satisfy growing demands. This production increases consumption of natural resources for industrial purposes, which in turn generates greater waste from the process of manufacturing and mining itself.

It is not only from the production of goods that wastes are multiplied; it is also in their consumption. The richer we become and the more we can consume, the more we have to throw away. Furthermore we somehow decided that it is now convenient to buy something and throw either it or its container away. Today almost everything is disposable, from diapers to dresses. We now even have disposable disposables. Unfortunately the use of such disposables is not the final solution to our solid waste disposal problem. Our castoff purchases must be put somewhere. Even if a product is utilized for a long period of time (a piece of furniture, a car, a television set), ultimately it will be discarded in some form—usually as junk. Ultimate disposal results in the disintegration of a product into its elemental components, as with the digestion of food or the burning of fuel. Our wastes must end up in the water, on the ground, or in the air, generally in a form making them unsuitable for further use.

Auto-pollution

The magnitude and complexity of the disposal problem is best illustrated by the complications that have arisen out of the production and consumption of the automobile. Affluence, the automobile, and aggravation seem to go together. For example, automobile exhaust is now the major cause of air pollution in many of our larger cities. Annual automobile production has risen from 3.5 million in 1947 to 9 million in the 1960's. The fumes produced annually by the almost 110 million combustion engines of America's automobiles, trucks, and buses are estimated to be 90 million tons of gases, including 64 million tons of carbon monoxide.[3] This constitutes 40 percent of all air pollution emissions and 60 percent of all carbon monoxide released into the atmosphere. The carbon monoxide alone is enough to poison the combined air space of Massachusetts, Connecticut, and New Jersey. The automobile is the king of American consumer goods, and it is also a complete portable factory. Every vehicle generates power and air exhaust just like a miniature thermal electric plant. Crossing behind a jam of cars stopped at a red light is a bit like walking behind a series of upended chimney stacks—all pointing in your direction.

Of equal importance, automobile junking, like the disposal of other consumer goods, has become a serious problem. Every year approximately 7 million vehicles are scrapped and must be discarded somehow. Fortunately many cars and trucks are recycled in the form of used cars and trucks a few years after their initial purchase, but ultimately even these vehicles must be removed from the streets. At one time this removal posed no difficulty; but beginning in the late 1950's, automobiles started to pile up in city streets and in automobile graveyards across the country. The metamorphosis of the discarded auto from a depreciated but still treasured pet into a valueless white elephant is a classic illustration of how changes in technology and economic factor costs combine to effect environmental disruption.

Scrapping scrap iron

Until the early 1960's steel was produced almost entirely in open-hearth furnaces. The metal charge fed into these furnaces often consisted of as much as 50 percent scrap iron along with the raw iron ore. Accordingly, used automobiles were sought after by junk dealers because of the value of the scrap metal. Despite the fact that other metals, such as copper and aluminum, were sometimes included along with the scrap steel in the melted mass, the technology of the open-hearth furnace was such that the quality of the steel it produced was not seriously affected.

Because both its construction and operating costs were often twice as large as the oxygen (LD) process of making steel, more and more American steel manufacturers began to close down their open-hearth furnaces and replace them with oxygen furnaces. Unhappily for the junk dealer, oxygen furnaces had a much lower tolerance for impurities and could take no more than 30 percent scrap in their metal charges. Inevitably the steel manufacturers began to substitute iron ore and taconite pellets for scrap. This in turn caused a drop in the price of scrap and the value of the junked auto.

The increase in national wealth produced a keener awareness of pollution for yet another reason. More wealth brought with it not only more products but also more leisure, making it possible for people to become aware of and to explore the countryside. More and more they found that what was left was becoming polluted. Invariably, this made an indelible imprint. A famous Michigan labor leader unexpectedly asked to testify before antipollution hearings conducted in Detroit. Since this particular leader had never taken much interest in pollution control before, he was asked to account for his sudden enthusiasm. He sadly explained that after years of hard work, he finally managed to buy a summer retreat. To his dismay, within a few years, the lake adjacent to this cottage had become polluted; from Shangri-la to cesspool. As one government official explained it. "This is how we win our most ardent supporters."

Exotic technology

3. A third factor influencing the seriousness of the pollution problem has been the rapid advance in industrial technology. It is not just that there are more of us and that each of us consumes more than did our fathers and grandfathers, it is also that what we consume is more complex in its material makeup. Each day products of an ever more exotic and synthetic nature are invented and distributed. It is estimated that 500 new chemical compounds are introduced by industry each year. Frequently these newly-discovered compounds are are not biodegradable—readily broken up into easily digestible or disposable byproducts. We may live better thanks to chemistry, but the products that result often live on long after the users are gone. Some products, such as aluminum tin cans, are virtually indestructible. The old steel tin cans at least rusted and disintegrated after a time. Unhappily, manufacturers are moving further and further away from products and containers like ice cream and its cone, ideal from the point of view of pollution control because they self-destruct in the process of consumption. Instead, both manufacturers and consumers are encouraging the use of permanent plastic cups and non-returnable bottles, which means greater convenience for the consumer but more litter on the picnic ground and roadside.

The tendency is to blame manufacturers for the switch to nonreturnable bottles. In fairness, it is as much if not more the fault of the consumer. The bottlers began to switch when they found that their customers were failing to claim their deposits for returnable bottles. From an average of fifty round trips per bottle in 1955, returnable bottlse were making only about ten trips in 1970. Many bottlers simply abandoned the use of returnable bottles altogether. Thus there is no longer monetary compensation for most bottle returns. The withdrawal of the economic incentive, small as it is, has simply accelerated the accumulation of clutter.

The effects of technology have been even more serious in other fields. Deadly pesticides and industrial wastes are composed of chemical derivatives that do not always break down easily. That, in fact, was what once made them so attractive. DDT sprayed on a plant did not dissolve and lose its effectiveness. As a result, malaria, one of the worst scourges of man, was virtually eliminated in vast parts of the world and DDT was regarded as a major boon to mankind.

. . . out with the bathwater

The soap industry is a prime example of how the thoughtless use of technology can disrupt the environment. In an effort to improve the cleansing impact and lower the cost of the product, the soap industry switched from a fat base to a nonbiodegradable detergent base—one that does not readily break down in the normal course of sanitary treatment. Consequently, pools of froth began to cover drinking water reservoirs, and floods of suds frequently returned to the household through the kitchen faucet.

We should remember that the initial stimulus to the development of both pesticides and detergents was a positive one. The well-being of mankind was to be advanced through the use of technology. It was assumed on the one hand, that health could be improved by eliminating the causes of disease and on the other hand that costs would be reduced and convenience improved by a switch to labor-saving but capital and environmental intensive products and processes. An important lesson to our heightened ability to tinker with be learned from the outcome is that technology may sometimes lead to unexpected and unfortunate results. The likelihood of such unanticipated consequences becomes all the greater as we industrialize and our ability to manipulate technology increases. In our efforts to improve on nature we sometimes find ourselves upsetting the ecological balance with potentially disastrous consequences. Invariably the engineers rush to our rescue with new solutions to the new problems we have created but in a short time we often find that their newest solutions have in turn generated a new set of difficulties.

The balance in the future, when still unanticipated difficulties may arise, is even more uncertain. We must recognize that as we increase our technological ability to "compensate" for nature's shortcomings, we are likely to find that the potential for negative by-products may increase even faster.

Pollution can kill

4. Finally, concern about environmental disruption has attracted additional support after a sequence of serious incidents. Because medical science has found more and more cures for our more traditional disease-causing enemies, we have become more prone to other ailments. Not surprisingly therefore, many people, especially the elderly, find themselves becoming affected more and more by pollution in the environment, especially the air. Thus poor air has been blamed for cancer, pneumonia, bronchitis, emphysema and tuberculosis. Scientists point out that by breathing the air in New York City, one inhales an amount of cancer-producing benzopyrene equivalent to smoking one or two packs of cigarettes a day. It is further claimed that air pollution is responsible for the 80 percent rise in deaths from respiratory diseases from 1930 to 1960.

Clearly delineated surges in the death rate have been traced directly to air pollution. Such incidents have occurred in Donora, Pennsylvania, in October 1948 when the death of 19 and the illness of 6,000 of the town's 13,800 citizens were blamed on smog. Smog was also blamed in London when the normal death rate rose by 4,000 in December 1952, and when 8,000 died prematurely in January and February 1953. Similarly air pollution was considered a major cause of death in New York City in January and February 1963 when there were 647 more deaths than normal. Some scientists also cite air pollution as a factor contributing to street riots in some of our large cities. In addition to the normally expected discomfort, pollution is said to generate depression and melancholia. As for water pollution, in 1965 at Riverside, California, 18,000 people were afflicted with gastroenteritis from the town's water wells, and three apparently died as a result. In Japan forty-five residents of Minamata died from mercury poisoning of the water in the 1950's, and 1960's. In the 1970's fears of similar incidents spread throughout the rest of the world as some fish were discovered to have excessively high mercury content. Even when no loss of life results, the massive environmental disruption that stems from disasters such as the sinking of the Torrey Canyon or the oil spills off Santa Barbara focuses world attention on the destruction we can inflict on one another, and more than anything else heightens our awareness of the problem.

Why do polluters pollute?

It is not difficult to understand why there is pollution of the air and water and even the land. Moreover it is not just industries and municipalities that are contributors. Some of your best friends insist on using their own septic tanks or cesspools rather than linking up with a public sewer system for the disposal of household sewage. Unless the soil conditions are suitable and the homes are located at sufficient distance, this could contaminate the ground water. When did you have your last cookout or throw a beer can on the beach or highway? Did you ever leave the car motor on while running an errand?

Few people stop to consider that they are polluters when they do such things. And if they recognize that they are creating some form of air, water, or solid litter, they always say to themselves that their little bit of waste will not make much difference. In addition it would cost more to have someone haul the trash and leaves away; it might be prohibitively expensive to link up a house with a sewer system. Similarly, industries and municipalities follow the same reasoning: it is cheaper, it is more convenient. Economists call the pollution which arises from such a situation an *external diseconomy*. To the polluter there never seems to be great harm in just his little pollution, but there may be great expense to society as a whole when it tries to clean up the wastes of many such polluters.

The waters are usually so plentiful and the sky so vast that it is hard to believe one person can cause pollution. In fact, one person usually cannot cause pollution; it is when there are numerous "one persons" who all think the same way that pollution results. Moreover when one person pollutes, he himself is not usually the one to suffer or bear the expense. In fact the private cost to the individual is most often cheaper if he does pollute than if he has to use expensive disposal equipment. If the water is polluted, it is the people downstream who are affected. If the air is polluted, it is the people in the direction of the wind. This is an instance where the private costs of pollution are almost always less than the costs to the rest of society. Pollution results from pushing off what should be your responsibility onto someone else who is usually anonymous. The effects are spread over such a wide area and affect so many people that generally no individual suffers enough damage to induce him to exert the effort needed to seek out and collect from the offender. Furthremore, the compensation that might be obtained from suing the offender and preventing future damage may not be worth the effort and cost involved.

Environmental lawsuits

There are exceptions. This becomes apparent if we divide the social costs into two categories: those that fall on the population as a whole and those that fall primarily on other producers. When the social cost of an operation is spread thinly over the entire area, no one may feel sufficiently damaged to take corrective action. However, if the smoke or discharged water from a particular factory moves downwind or downstream to an adjacent factory, the adjacent factory may feel the effects so severely that the polluted air or water becomes a direct cost of operation. In this case, the downstream or downwind factory is more likely to take action to force the offender to absorb and bear his own social costs.

This can lead to some peculiar situations. The Everett Station of the Boston

Edison Company draws on water from the Mystic River for use in its boilers and for cooling. Unfortunately, a Monsanto chemical plant is located slightly upstream from the generating plant and discharges various chemical wastes into the Mystic River. This makes it necessary for Boston Edison to provide extra treatment for the water it uses. Therefore Boston Edison supports all efforts to force Monsanto to clean up its effluent. At the same time, however, until recently Boston Edison dragged its feet when others urged a reduction in sulfur and particulate content of the air discharged from its chimney stacks. To do this, it argued, would increase its costs of operation.

Who's been hurt?

For the most part, however, it is usually quite difficult to assign and assess responsibility for damages in cases of external diseconomies. For example, if a second factory decides to locate next to a factory that has been polluting for decades in splendid isolation, away from all industry and homes, should the original factory be made to bear the cost of cleaning up the pollution? Why should this factory suddenly be made to pay for something it has been doing for years without visible or sufficient economic damage or complaint until the neighbor moves in alongside? Moreover if several polluters are located along a lake or are affected by one another's smoke when the wind shifts, who should bear the responsibility—the most recently completed factory? Its smoke or water may have caused the ecological system to break down, but is it ultimately to blame? In other words, who is responsible—all the men who have put straw on the camel, or just the last man before its back is broken? Clearly it would be unfair to compel the new firm to purchase expensive pollution control equipment and allow the older firms to produce waste as freely as before. This would put the new firm at a competitive disadvantage and would also discourage the location of new industry in the neighborhood. Yet if the old firms were required to buy pollution control devices, they might move out to other areas which were more permissive. Similarly, factory management could argue very persuasively that even if hundreds of thousands of dollars were spent to clean up wastes, the pollution problem might still exist unless the other firms and towns in the area were also forced to clean up their waste. Management would have to justify such expenditures to stockholders who might wonder if such expenses are warranted when they add absolutely nothing to sales revenues. Viewed from the perspective of the industrial unit such expenses are nonproductive and, if anything, benefit primarily the downstream or downwind company or town.

The price system fails . . .

Obviously in such circumstances the traditional price mechanism that we rely on to guide us in the production and distribution of most of our natural wealth can do nothing to solve the problem. Normally through the market system, prices are used to balance off the demand pressure for a product with all the production costs involved. In this way goods can be purchased by those who are willing and able to pay a high enough price for them. This, we say, shows that private costs equal private benefits. It should be pointed out that the concepts of private costs and private benefits are not peculiar to nonsocialist societies. They also exist in the USSR, since Soviet enterprises and cities are held responsible *only* for their private costs, or charges that can be specifically and directly assessed to users of the input. As in the United States, no one in the USSR has been able to break down social costs and attribute them precisely to their source. And despite a faulty price system in the USSR, when two inputs are equally productive, the factory manager in both the United States and the USSR will use more of the input that is cheaper. For example, if wages are relatively cheaper than rents, he will use more labor than land. In other words, given a certain level of production, a manufacturer will use that mix of inputs that will cost him the least.

The price a factory manager is willing to pay also indicates that he usually expects to receive at least that much benefit from the product. Each productive resource is used until the cost of an additional unit is just equal to the extra revenue that resource will bring to the producer. When all products react in the same way, then the price that must be paid for the productive resource will tend to equal the value of the product which is produced.

If demand for a good increases, the price will be increased. This in turn should induce an increase in production. Prices will rise also if the raw materials used in the production process become harder to find, or if workers suddenly decide they would rather work elsewhere. When the costs of production factor inputs are increased, the manufacturer tries to pass this on to the consumer by raising the sale price. It also happens in most instances that when the cost of production rises, it is necessary to cut back production to make sure that there is no overproduction. Higher prices usually mean fewer purchasers.

It is also essential, if the price system is to function properly, that someone or some group control and sell or otherwise allocate all the factors of production. Thus, whether they be landlords, bankers, laborers, or managers, fees are collected for the use of an input which presumably provide proper compensation for the cost of reproducing the article or for the revenues foregone by not taking advantage of opportunities available elsewhere. In this way, the costs of all inputs used in the production process are properly identified. Thus we can say that private benefits and costs equal social benefits and costs since no resource is utilized unless someone is compensated for it at a rate which usually will reflect the demand and supply pressure for the good.

Who owns the air?

One of the reasons that air and water pollution is hard to control is that no person or organization is normally considered to be the owner of the air and water. With few exceptions such resources are considered to be readily available to those who want to use them. It is difficult to attach a value to either clean or dirty air and water. They are often treated as if they are free goods.

The price system cannot be expected to function properly, however, if the factor inputs are priced improperly or are not priced at all. If a factor is overpriced, this will lead to the increased price of the final product and a reduction in the amount sold. Conversely, if the factor is underpriced, then the selling price will not reflect the full cost to society of all the inputs that are involved, and more of the good will be sold than should be. At the same time, more of the resource will be used in production than if only the price of the factor properly reflected the alternative used to which it might be put.

Abuse of water and air resources comes about then largely because air and water are undervalued. Air and water are regarded as free goods. For example, officials in New York City have long resisted the plea of economists and conservationists that meters be installed to measure all household use of water. Since there is no economic incentive to conserve water, there is great waste. In other words, no effort is made to "economize." Without exception, the failure to attach a proper value to something like water results in increased consumption. When water meters and water charges were introduced throughout all of Philadelphia in 1960, water consumption declined by as much as 28 percent. All too frequently we have failed to distinguish between rain and readily available drinking water and between air and fresh air. As one critic has said, it is as if there had been no differentiation between grass and milk.

The mere imposition of a fee for the use of air and water, however, does not guarantee an end to their irrational use. There is still the risk of excess consumption if the fee is not directly related to the benefits or cost of using the water. This can best be illustrated by an example. Assume that 100 people agree to share a phone and the phone bill. Each person would feel strongly tempted to make an unlimited number of long-distance calls because he would have to pay only one-hundredth of the bill. Unfortunately, each of the other participants would feel exactly the same and the result would be a flood of long-distance calls and an unusually large phone bill. We abuse our air and water resources in exactly the same way. Even when there is a fee for water usage and sewage discharge, the fee is often understated or subsidized with income from some other source. If, however, the price of water were increased, it would become a more valuable commodity and therefore more care would be taken to utilize it efficiently.

The social costs of pollution:

Because they are generally considered to be nonmarketable products, it is difficult to evaluate the costs of polluting water and air. Cost in this context refers to the *damage* that arises because of environmental disruption; the question of how much it would cost to *remedy* environmental disruption will be considered next.

Cost estimates of damage caused by pollution are hard to make. Various estimates are tossed around, but generally they are not based on solid research or calculation. Moreover once a figure is suggested by someone, it is often grabbed by everyone else until gradually it is accepted as the basic truth. In time the original source and the qualifications surrounding the calculation are forgotten and only the basic figure remains. Yet before there can ever be a workable solution to the pollution problem, some estimate of the cost of the damage from pollution must be made so that proper values can be assigned to air and water. The task is made even more complex because so many things affected by pollution—swimming in a river or smelling clean air—are impossible to price. Even when pricing the damages is no impediment, a decision must nonetheless be made as to how far back the researcher should go in counting up the damages. Does one include just the primary effects or the secondary and tertiary damage as well? If smoggy air necessitates the closing of an airport, should one count not only the loss in revenue from the inability of planes to fly but also the business transactions that were not consummated because salesmen were unable to reach waiting buyers?

Delayed impacts

It also happens frequently that damage arising out of some act only becomes apparent years later. For example, it has taken about twenty years for us to realize the extent of the harm caused by the use of DDT. We should reckon from the first use of the insecticide if a proper accounting of the costs is to be made. Also it is not always easy to ascribe correctly an economic loss to pollution. A house in a factory district may be priced low but how much of this is due to pollution and how much of it is due to environmental factors which might also exist in the area? Finally, how much crime and other abuses are due to pollution which hastens the exit of more socially responsible elements of the population?

There are countless illustrations of the difficulty of providing a measure of the cost of pollution damage. Because of emission of industrial waste into Lake Michigan from Chicago's South Side, it was necessary to close several beaches on the lake in 1965 and 1966. It turned out that Blacks were the predominant users of two or three of these beaches. When the industrial and municipal polluters complained about the cost of an accelerated cleanup schedule, federal authorities replied that failure to reopen the beaches might touch off race riots. Such riots would be directly attributable to the withdrawal of recreation facilities because of the pollution, and the blame would rest squarely on the shoulders of the polluters. Whatever the material costs that might have resulted from the damage and the additional costs necessitated by travel expenditures to other swimming sites, and the building of substitute swimming pools, the polluters apparently agreed that there were also political and public relations costs involved which more than justified expensive remedies. The accelerated cleanup program was accepted.

Other costs of water pollution should include estimates of the damage suffered by the fish industry. The shellfish industry is claimed to have suffered a $45 million loss because water pollution in tideland areas led to the spread of hepatitis through the clam and oyster beds. Estimates can also be collected of the losses suffered as a result of the destruction of sword- and tunafish arising from the mercury poisoning scare of 1970 and 1971. Tons of such fish were ordered withheld from sale and untold monetary losses resulted from price reductions caused by customers' avoidance of the uncontaminated fish on the shelves.

The price of life

Many other estimates of cost must be handled in an equally arbitrary fashion. What value should be placed on the premature death of an engineer from asthma ineducd by polluted air? Is a retired engineer who dies worth as much? What is the cost to society of "blue babies" who suffer from methemoglobinemia? This results when oxygen is boiled off from polluted water used to make baby formulas so that what remains contains increased quantities of nitrogen, which has an adverse effect on the stomach and bladder. What is the cost of mercury poisoning? How does one determine the value of the 116 Japanese citizens who were paralyzed or killed by mercury poisoning at Minamata? In addition to the expenses of medical care, should we also calculate the loss in earning power of pollution victims in the years to come?

Somewhat less tenuous but still arbitrary are the estimates of the losses due to plant closings or relocations because of pollution. Even more questionable are the estimates of the losses from industries which decide not to locate in an area because of pollution. For places like New York City, these are vital but obviously difficult questions to evaluate. Estimates of this nature have been made to show that the benefit to Pittsburgh of clean air would offset the costs involved in trying to clean it. Whatever losses due to industries that left Pittsburgh because they could no longer use the skies as sewers were more than offset by other industries and institutions newly attracted to or contented to remain in a cleaner Pittsburgh. Today Pittsburgh is a city with a revitalized economy. Moreover what was once America's smokiest city now has air quality that is comparable to most American cities of its size.

Measurable economic losses

A specific case of air pollution's effect on the costs of operation of a firm is illustrated by what happened to the companies that fill air tanks for scuba divers in New York City. Public health officials suddenly realized that the air tank companies were compressing polluted New York City air into their tanks. It was bad enough for those who have to breathe New York air in more relaxed circumstances, but to have to breathe it in concentrated form several feet under water was obviously dangerous. Accordingly, the New York City Air Pollution Control Act of May, 1966, prohibits the sale or distribution of compressed air tanks for underwater breathing use without special permits. The cost of air pollution in this case could be measured by ascertaining how many compressed air companies have been forced to close their doors and how much existing firms have had to spend in new equipment necessitated by the new law.

In the same category of cost estimates is the loss to the optical industry that comes from the difficulty of selling contact lenses in a city like New York. Doctors there have found that it is extremely dangerous for their patients to wear contact lenses for any length of time because of the possibility of lacerations to the eye. Specks of dirt and ash are periodically caught between the retina and the lens. Presumably the loss entailed from this could be calculated by determining the per capita use of contact lenses in other less polluted cities and then comparing this with similar ratios in New York City. To this should also be added the cost of eye surgery necessitated by pollution.

Attempts have also been made to evaluate any additional living costs for a family in an air-polluted area. In one of the few systematic studies ever made, Irving T. Michelson of Consumer's Union in New York City estimated that a family owning its own home in New York paid over $800 (or $200 per person) more a year than a family located in a less polluted area. He estimated that families living in apartments pay on the average of over $400 more. This includes added expenditures for household maintenance—extra painting, cleaning and washing, extra laundry bills—and extra medical expenses, replacement of clothing, fewer sunlight hours, and lower real estate values.

Michelson's figures may be a little high compared to $65, the figure most commonly cited as the cost of air pollution pre capita in the United States. Unfortunately no one really knows whether Michelson is high, low or in the middle. One of the most embarrassing acknowledgements that economists studying environmental disruption should make (and often don't) is that so few studies have been made of the cost of air or water pollution. Some economists have tried to determine the effect of air pollution on land values, and one or two pioneering efforts to detremine costs have been made, but the results so far suggest that no one need worry that the subject has been exhausted.[1]

Analysis or guesstimation?

The estimates of losses endured because of environmental disruption are not much better than estimates of the cost to eliminate environmental disruption. Almost all the same statistical hazards also apply here, and there are also several extra pitfalls. First, there is confusion between the costs required to construct an adequate treatment system and the costs of operating that system—often the figures are used without making distinction. Second, it is not always clear just what the elimination of environmental disruption would mean. Thus when speaking of water treatment, is the goal secondary treatment or the more elaborate tertiary treatment? Primary treatment of one thousand gallons of water with removal of one-third of the Biochemical Oxygen Demand (BOD) costs about 3-4¢ per thousand gallons.[2] (For a definition of BOD and an explanation of what is involved in the various stages of treatment, see the Goldman and Shoop article in Part 1.)[*] Secondary and primary treatment of a similar quantity of water, in which 90 percent of the BOD and about one-third of the nitrogen and one-third of the phosphates are removed, costs about 15-20¢ Another 15-20¢ must be added for the tertiary treatment of water, so that total costs amount to 30-40¢ per thousand gallons.[3] But we are a long way from reaching the goal of even secondary treatment in the United States. Currently the homes of 70 percent of our population are served by some kind of sewer system. However the sewage from about 7 percent of these homes (involving 10 million people) is discharged directly into our water courses as raw sewage. Only about 43 percent of the American population (about 85 million people) is served by secondary sewage systems.

Where nature's way won't work

For many people living in isolated areas there is no need for secondary treatment or even for sewers. A septic tank or even an outhouse may adequately treat such waste if the site is isolated enough. (In effect, this is nature's way.) As people continue to crowd into urban areas, however, the need for sewers and secondary treatment grows. The Federal Water Pollution Control Agency (now the Water Quality Office) estimates that by 1974, 90 percent of our urban population will need secondary sewage systems. To bring us up to that level, expenditures of over $10 billion in water treatment plants (exclusive of land costs) and over $6 billion in sewers will be required during the years 1970-74.[4] To separate storm and household sewers could cost anywhere from $15 to $50 billion.[5] Construction of secondary treatment facilities for industrial wastes will require close to another $5 billion, and control of sediment and acid drainage from mines could require from $2 to $5 billion. To control thermal pollution (overheating the water by discharging water used for cooling) will cost yet another $2 billion although heightened standards may soon necessitate a figure as large as $4 billion. This would bring the total investment required for industry to something like $9 and $14 billion. Total capital requirements for secondary treatment of water therefore will probably range between $40 and $80 billion. The Federal Water Pollution Control Administration estimates that annual operating costs for all these facilities would reach almost $2 billion for municipal plants, $3.5 billion for industrial plants, and about $1 billion for thermal processes.

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[*] This is a reference to Part I of the original publication of this article: *CONTROLLING POLLUTION: The Economics of a Cleaner America.*

If we were forced to move to tertiary treatment, the total for all construction costs in Table II would probably jump from $40 billion to about $90 billion. Even if very few American cities decide to move to tertiary treatment and only a few spend the money to separate storm and household sewers, it is still easy to see why some authorities estimate the ultimate cost at close to $100 billion.[6]

Costs to producers

It is necessary to remember that not all of this expense is incurred at the treatment end of the process. Large sums of money will also have to be spent periodically by manufacturers to alter their product mixes to make them less destructive to the environment. For example, it is calculated that the shift to soft or biodegradable detergents cost the chemical and soap industry over $100 million. Such a move was ordered in Germany in October 1964, and later adopted by individual American states like Wisconsin because more and more sewage plants found they could not eliminate the growing sea of suds in their sewage. Finally in July 1965, the whole American chemical industry started to make detergents out of linear alkylate sulfonite instead of the hard alkyl benzine sulfonite, that could not be decomposed easily in most sewage treatment plants. About five years later the soap manufacturers were faced with the need to spend millions of dollars more to make another set of changes. This time the focus was on the reduction of phosphates in the detergents. The usual secondary treatment system is unable to remove sufficient quantities of phosphates from the water. Since phosphates are also used as fertilizer, the discharge of large quantities of phosphates into the water has had the effect of stimulating the rapid growth of aquatic plant life. This has increased the spread of algae and seaweed, which in turn eat up the oxygen in the water, hasten the formation of swamps, and accelerate the demise of the water course. (Technically this is called eutrophication. What is happening to Lake Erie is a prime example.) While one solution to this problem would be to build tertiary treatment plants across the country, the cheaper approach is elimination or reduction of the phosphates at the soap factory before they even enter the sewers. Nonetheless the search for a suitable substitute and the alteration of the production process will seriously affect an industry which

TABLE II: *The Costs of Air, Water and Solid Pollution Control for the Years 1970-74 (in billions of dollars)*

	Total Construction Costs	Annual Operating Costs
A. Water Treatment Costs		
(Secondary Treatment		
1. Household sewage		
a. Treatment plants	$10	
b. Sewers	$6	
	$16	$2
2. Sewer separation	$16	
3. Industry	$15-$50	
a. Industry treatment costs	$5	$3.5
b. Sediment & acid drainage costs	$2-$5	
c. Thermal pollution	$2-$4	$1
	$9-$14	
Total Secondary Treatment	$40-$80	$6.5
Tertiary Treatment	$90-$100	
B. Air Pollution		
1. Stationary sources	$8-$10 ($50-$100)*	
		$.3-$2
2. Automobile pollution	$1-$2	$2-$3.5
C. Solid Waste	$1-$3	$3-$8
Total Pollution Control		
(Secondary Water Treatment Only)	$50-$95	$12-$20

does a business of about $4 billion a year. Similar examples of how money for pollution control has been spent before the product was produced, rather than on the treatment of the resulting effluent, can be found in the production of paper, where manufacturers stopped using the sulphite process and switched to the sulphate process.

Manufacturing fresh water

Another way to calculate the cost of eliminating water pollution is to see how much it would cost to manufacture fresh water. This presumably would represent the outer limit of possible costs, but in some areas reprocessed water is the only alternative source available. Therefore the cost of such reprocessing might serve at least as the upper limit for the value of the water, even though such estimates do not measure the cost of pollution directly. This may be a fairer estimate of the cost of polluting the water, since the practice otherwise is to set the price of fresh water at the amount necessary to cover only the operating costs of the well. Such a system fails to make allowance for the fact that the well may be slowly going dry, as is often the case in the West.

Traditionally attention has been focused on the cost of refining sea water. Given present technology, this is quite expensive. The best desalinization plants can almost produce drinking water at a cost of one dollar per thousand gallons. The facility at the United States Naval Base in Guantanamo, Cuba, produces one thousand gallons for $1.16. This is a considerable improvement over the $14 per thousand gallons that water desalinization cost in 1952. At one time it was hoped that with the aid of special subsidies, an atomic-powered desalinization plant could be built to serve Los

Angeles. It was assumed that the subsidies, combined with the revenue from the sale of electric power, would make it possible to price water at about 27¢ per thousand gallons. In late 1970, E. I. du Pont de Nemours & Co. introduced a reverse osmosis system that costs from 25-65¢ per thousand gallons depending on the salinity of the water and the scale of the desalinization plant. Yet unless special subsidies are provided, as was contemplated in Los Angeles, it is unlikely that desalinated water will be cheap enough to compete with the normal cost of well or reservoir water which averages about 15¢ per thousand gallons. However if the cost of sewage treatment is added in, the total cost is closer to about 23¢ per thousand gallons. Some authorities have argued that this cost disparity between fresh water and desalinated water will always exist because scientists are misdirecting their attention toward desalinization. Instead such critics urge that more effort be devoted to reusing sewage water. Sewage often has only 1 percent impurities while sea water has about 3 percent impurities and therefore is harder to clean.

Getting rid of sewage

A related problem is the disposal of sewage water. In some areas there is no convenient body of water that can be used as a dumping ground for a city's sewage. This is the problem at Lake Tahoe. If the lake, one of nature's purest, is not to be used as a sewer itself, some other repository must be found. Unfortunately there are no other outlets available in the area so plans have been drawn up to pump the sewage several miles over the mountains. Conservationists in the USSR have argued for a similar arrangement to dispose of effluent from the paper plants on Lake Baikal, but to no avail. The Russian authorities simply argue that it is too expensive.

Santee, California, also had a disposal problem. A treatment plant was built and the water was then further purified by being run over a dried-up riverbed. After a mile of this natural filtration, the water was stored in small artificial lakes stocked with fish and opened to boating. Although unfit for drinking, some of the water is being sold to golf courses for watering the grass. The price is 12¢ per thousand gallons, which is cheaper than fresh water. Since some nutrients are probably still left in the water, this may actually turn out to be a bargain since the water can aso be used as a fertilizer.

Estimates of eliminating air pollution are even more complicated. Projected operating costs range from $300 million a year to $2 billion and capital costs over the five years from $8 to $10 billion.[7] According to the maximum forecast, that would mean capital expenditure of slightly less than $100 billion by the year 2000. Twenty billion dollars is probably a much more reasonable figure. But these cost figures only cover emissions from stationary sources. Currently, the greatest source of air pollution in many cities is the automobile. A variety of solutions for reducing emissions from the internal combustion engine have been suggested. They include everything from outlawing the combustion engine itself to eliminating gasoline with lead. The cost of the cure varies with the severity of the remedy. There seems to be some agreement (this may merely be a sign that everyone is repeating the original estimate) that proper control equipment and the elimination of leaded gasoline would result in a 10 percent yearly increase in the cost of operating an automobile. The cost per car would be about $30 a year based on the average per capita expenditure of $300 a year that Americans spend on their automobiles. For the country as a whole, the total annual outlay could range from $2 to $3.5 billion.

Another cause of air pollution is the jet airplane. Generally airlines claim that they contribute only 1 percent of the nation's air pollution. However, the amount of jet pollution varies from city to city and neighborhood, depending on proximity to the airport. New York City reportedly receives one and a half tons of air pollutants a day. As a result of new laws instituted by officials in New Jersey and Chicago, which now allow state officials to exact fines as high as $5,000 for planes which violate exhaust standards, the airlines have agreed to curb their exhaust emission by 1972. Initially airline officials claimed this would cost $30 million. Subsequently they lowered their estimates to $12-$15 million.

Benefits from clean air, water

Although it is not indicated in Table II, it is necessary to remember that some of the cost incurred in reducing water and air emission will be offset by savings that come with cleaner air and water. One benefit of cleaner air would be a reduction in cleaning bills and medical expenses. Another saving will result from increased utilization of the by-products of combustion. This will permit greater recycling of nature's resources and will mean less exploitation of new resources. It is estimated that approximately 23 million tons of sulfur dioxide are discarded into the air each year as part of the combustion process. If recovered this could provide about 5 million tons of sulfur or 15 million tons of sulfuric acid. Although the price of sulfur has fallen in recent years so that recovery is less attractive than it once was, such a program of resource reuse would virtually satisfy the entire demand for some sulfur compounds.

Institution of $50 to $100 billion worth of air quality controls over the next few decades would not mean the elimination of all air pollution, nor of the costs that arise from it. Nevertheless, substantial savings could be realized and therefore used to defray the cost of the annual expenses envisaged as necessary to clean up the air. This could go a long way if not all the way toward offsetting the annual $5 to $13.5 billion in operating expenses that would be needed to curb air pollution as indicated in Table II.

The cost estimates for solid waste disposal are somewhat less complicated but still something less than precise. They are less complicated because in the present state of the art, the technology is even more primitive than it is in water and air treatment. Usually solid waste disposal involves nothing more than an incinerator and often just an empty field and a fleet of dump trucks. Sophistication may mean nothing more than an automobile shredder which may cost $3 million. Under the circumstances, the capital expenditures required for solid waste disposal are negligible compared to the investment required for air and water treatment. Thus to dispose of the estimated 5 pounds a day in household waste discarded by an average American, the major costs are collection, transportation and disposal. It is estimated this amounts to from $3 billion to $8 billion a year.

Bottom line: about $100 billion

It is unlikely that the exaggerations have balanced the understatements of these various estimates. Consequently combining the sums of the different construction projects and operating costs makes it doubtful that the uncertainties stressed above have been eliminated. Having gone this far however, we might just as well add them together to have a rough picture of how much they would all cost. The overall total of the different projects indicates that reducing environmental disruption could cost anywhere from about $50 billion to something approaching $100 billion. Annual operating costs would probably range from about $12 to $20 billion. These operating costs amount to approximately 1 to 2 percent of the annual GNP and 4 to 7 percent of the value of our industrial, agricultural, mining, and transportation output. Construction costs average about 3 to 7 percent for industry but may total more than 10 percent of the capital costs of some projects.

It is necessary to reemphasize that all such calculations are imprecise.

Even if it is assumed that we know what standards we want to attain, it is still hard to project meaningful figures. Treatment technology is as yet relatively primitive. Technological breakthroughs could reduce costs significantly. Moreover, the estimates will be affected by what happens to population growth and concentration. If population increases, so will costs. It will also depend on what new industrial processes complicate existing treatment methods. Care must also be exercised in judging cost estimates because there is a tendency to overstate costs. Sometimes this is done by those who feel that the only way to obtain action is to create a crisis atmosphere. Regrettably, too often it takes a scandal or crisis before public support for meaningful programs can be obtained. At other times the costs are exaggerated for just the opposite reasons: to discourage pressure for change and also to win admiration for the expenditures already made. This is understandable, since almost everyone agrees that pollution control expenditures usually add nothing to profits. On the contrary, they generally result in diminished profits for industry (except for the producers of pollution control equipment) and in higher taxes.

Man's work or nature's?

Finally, it is difficult to determine how much man must do to clean up his water and air. Up to a certain point, water courses and air sheds have a natural self-cleaning power. This regenerative process has served admirably for the last several thousand years. It breaks down, however, when a threshold is passed and the amount of newly added dirty water and air suddenly overtaxes nature's cleansing capacity. The question that arises is how much should we expect nature to do on its own and how much should we require man to spend to facilitate the process? In some cases, man's help is a necessity; in other cases it is unnecessary. Deciding where nature's work ends and man's work begins is not easy.

One of the greatest challenges open to an economist today is to make a careful study of the effects of pollution. Unfortunately neither exaggeration nor understatement will ordinarily advance the long-run cause of those who seek reliable economic data. Until there are reliable estimates of damage, no appropriate value can be attributed to clean air and water. And, as long as the cost of clean air and water is undervalued, they will be used wastefully and irrationally.

Some critics have argued that the only long-run solution to environmental disruption is to call a halt to industrialization and economic growth. They argue that it is our fetish growth that has caused such abuse to nature. To some extent they are right. Industrialization is like cooking an omelette. There is no way to avoid cracking eggs. Not only is this hard on the egg, but we then have the shells to dispose of. Yet it is unrealistic to expect that many people will agree to forego their expectations of increased comforts, much less give up existing comforts.

Notes for Paper 3

[1] Robert E. Kohn, "Evaluating Air Quality Standards by Comparing Abatement and Damage Trade-offs Between Pollutants," mimeographed, paper presented at Winter Meeting of the Econometric Society, December 8, 1969; Robert J. Anderson, Jr. and Thomas D. Crocker, "Air Pollution and Residential Property Values," mimeographed, paper presented at Winter Meetings of the Econometric Society, December 28, 1969.

[2] Fred Singer, "Environmental Quality; When Does Growth Become Too Expensive?" mimeographed paper presented in the Symposium "Is There an Optimum Level of Population?" American Association for the Advancement of Science, Boston, Mass., December 1969, p. 13.

[3] *Ibid.*; Gene Bylinsky, "The Limited War on Pollution," *Fortune*, February 1970, pp. 104-5, 194.

[4] Federal Water Pollution Control Administration, U.S. Department of the In-

terior, *The Cost of Clean Water*, Summary Report, Vol. I (Washington, D.C.: Government Printing Office, March 1970), pp. 5-8.

[5] A system of holding tanks for the temporary storage of storm water overflows might obviate the need to construct separate sewers. This would cost a mere $15 billion. (See *ibid.;* also *New York Times*, February 25, 1970, p. 59; Fortune, February 1970, p. 195.)

[6] *New York Times*, March 17, 1970, pg. 29. CEQ *Environmental Quality*, Second Annual Report (Washington, D.C.: Government Printing Office, August 1971), pp. 111, 123. The CEQ's cost estimates for 1970-75 are slightly lower than ours would be if extended to 1975.

[7] Committee on Public Works, United States Senate, *On Pollution*, 1967. (Air Quality Act) S. 780, Part 3 (Washington, D.C.: Government Printing Office), p. 1361; *Fortune*, February 1970, p. 123; James J. Hanks and Harold D. Kube, "Industry Action to Combat Pollution," *Harvard Business Review*, September-October 1966, p. 57; The Working Committee on Economic Incentives, *Cost Sharing With Industry?* (Revised) (Washington, D.C.: Room 325, Executive Office Building, November 20, 1967), p. 21, CEQ Second Annual Report, p. 111.

II.4 Residuals & environmental management

Blair T. Bower *

Environmental resources have one feature in common: they are subject to congestion. In a low-density or economically undeveloped setting, an additional user of the natural environment may well impose essentially no cost on other users. As the density of development and the level of output increase, in the face of finite environmental resources, each additional user will impose additional costs associated with congestion on other users. This condition is termed an "externality" by economists—that is, the additional user does not take into account the costs he imposes on others in his decision to use a common property resource. Because there are no prices on the services rendered by the environmental media and since they cannot be exchanged between buyers and sellers in a market context, the usual mechanism in a market economy is not effective in limiting the use of environmental resources. This leads to excessive use of the natural environment, with resulting environmental "pollution,' and the necessity for collective or public management.[1] The same failure to consider the finite assimilative capacity of the environment has resulted in overuse and environmental pollution in non-market economies as well.

One of the major problems for environmental management stems from the use of the environment for the disposition of residuals, the "leftovers" from production and so-called consumption activities. There are, of course, other aspects of the environment as a common property resource which do not involve residuals, but rather involve the direct effects of economic activities on the use of the environment. Examples are the impacts of the design and location of transmission lines, billboards, highways, and other transportation facilities on the testhetic appearance of the landscape; modification or elimination of unique historical, scenic, and ecological resources by man's activities; and the direct impacts of mining and forestry activities on the visual qualities of the landscape and hence on other uses.[2] Only the residuals aspect of environmental management will be considered here.

Residuals and the environment

Residuals, operationally defined, comprise—at a given point in time—the difference in weight and energy between the fuel, food, and raw material inputs to production and so-called consumption activities, and the outputs of those activities. Among the outputs are services such as heat and light; durable and nondurable consumer goods; the liquid, solid, and gaseous residuals which are not yet recycled into production; and energy residuals such as waste heat and noise.

Several "facts of life" with respect to residuals must be understood. First, the generation of residuals is pervasive; all human activities result in the generation of material and energy residuals. In fact there are no "consumption goods." So-called consumption goods eventually become residuals—junked cars, discarded furniture, demolition materials from urban redevelopment. Goods which have traditionally been labeled as being "consumed," in reality only render services temporarily. Their material substance remains in existence and must either be reused or eventually discharged into the environment, the only two methods of disposition possible.

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The law of conservation of mass cannot be denied.

An important corollary stems from this first fact of life. Prohibiting the discharge of all residuals into the environment—in effect placing an infinite value on "virgin" environmental quality—would make production of goods and services impossible, because no physical process is totally efficient.[3] Even in an economy in which total reuse were practiced, an economy which is simply impossible on a planetary scale, the energy requirements for physical recovery and reprocessing of residuals for reuse inevitably produce at least one unavoidable residual—heat.

The second fact of life is that there are physical, technologic, and economic interrelationships between the two major types of residuals—material and energy—and among the various forms of material residuals—gaseous, liquid, solid.[4] Efficient and equitable residuals management cannot be achieved by dealing separately with individual residuals or individual environmental "media." Air quality management, water quality management, and solid residuals management should not be approached as separate activities.

The third fact of life is that the incremental costs of removing additional quantities of residuals prior to discharge into the environment increase very rapidly as 100 percent removal is approached.[5] The cost of removing the last increment of a residual is substantially higher than the cost of removing the first increment. It must be remembered that the traditional so-called waste treatment processes merely modify the original forms of residuals. These processes themselves require inputs of materials and energy and result in the generation of residuals. Essentially the objective of such processes is to modify the form of residuals to other material or energy residuals which presumably have less adverse impacts on environmental quality and on those exposed to the environment. Thus, it is clearly impossible to prevent completely the discharge of residuals.

The fourth fact of life is that all production and consumption activities utilize the assimilative capacity of the land, air, and water environments. While the services rendered by these environments are essential inputs into these activities, traditionally, no prices have been placed on these factor inputs. Hence, far more of them have been used than would be the case if the damages stemming from their use were properly taken into account through pricing. An optimal level of use would result under the proper pricing of environmental assimilative capacity.

Residuals and social choices

Having described the role of the environment in providing residuals assimilation services, we can consider some of the salient issues and the societal choices they reflect.

First, the driving force of the residuals problem stems from the proliferation of goods and services "demanded" by an affluent society. The "throw away" philosophy has important implications for residuals-environmental quality management. Thus, to produce a specified set of goods and services, the total materials throughput necessary—and hence the quantity of residuals generated—decreases as the efficiency of utilization, including reuse, increases and the useful lifetime of goods increases. The longer machinery, cars, buildings, and other "durables" last, the fewer new materials are required to compensate for depreciation and/or to sustain a given rate of capital accumulation; consequently fewer residuals are generated in total. The same is true with respect to energy production—the more efficient combustion and energy generation processes are, the fewer residuals will be generated for a given energy output.

Second, there are many alternatives for handling reisduals and for affecting environmental quality. These involve policy decisions relating to types of raw materials permitted for use in production processes, types of product outputs permitted, pricing policies relating to residuals discharges, location of economic activities in space, levels of environmental quality desired, distribution of costs of improving environmental quality, and specifications relating to methods for handling residuals (such as requiring specific levels of "waste treatment" rather than specifying a permitted quantity of discharge or establishing an effluent charge on each unit of residual discharge).

Third, environmental quality varies both in time and space, because of time variations in assimilative capacity of the various environmental media and in generaton and discharge of residuals. Failure to consider the time and spatial variations of assimilative capacity can double, or more than double, the costs of achieving a desired level of quality.

Fourth, some types of residuals-environmental quality management policies can have significant economic impacts beyond the particular area or region in which the policies are applied to residuals dischargers. For example, it has been estimated that requiring the use of low-sulfur coals to reduce sulfur dioxide discharges could result in the unemployment of 25,000 to 40,000 miners in Pennsylvania, Ohio, Illinois, and Indiana—at least in the short run.

Fifth, because environmental quality is comprised of a "mix" of elements, or environmental quality indices, and because not all the benefits corresponding to different levels of each index of environmental quality can be estimated, what is an optimal mix of environmental quality considering the range of residuals which affect the various environmental media and their users? Is a mix involving a reduction in liquid and gaseous residuals by 85 percent, lowering the intensity of background noise by 25 percent, and reducing the visibility and proximity of solid residuals by 50 percent better than, as good as, or not as good as a "mix" represented by reductions of 50 percent, 50 percent, 25 percent, respectively—or any other combination?

Decisions and choices within the environmental sector are linked to decisions and choices in other sectors of the economy. Just as there are limited environmental resources, so there are limited human and capital resources. Environmental planning and management must explicitly recognize this allocation problem and seek to articulate the multiple trade-offs among societal values involved.

Notes for Paper 4

[1] Manmade facilities, such as most roadways, bridges, and public recreation spaces, take on similar common property or collective good aspects, including congestion, as long as access to them is not controlled by property rights.

[2] These activities also typically result in the generation and discharge of residuals.

[3] It should be emphasized that the discharge of a residual into one or more of the environmental media does not inevitably result in a change in environmental quality. Nor do all changes in environmental quality have adverse effects.

[4] Water-borne, air-borne, and land deposited is another system of classifying residuals. Here again there are interrelationships. For example, some air-borne residuals are deposited on land and/or on water courses via "washout" from the atmosphere.

[5] For discussion of this point, see, Kneese, A. V., and B. T. Bower. (1968) *Managing Water Quality: Economics, Technology and Institutions* (Baltimore: Johns Hopkins), pp. 44-62.

II.5 A Local government administrator view of environmental management

Charles T. Henry *

Awareness or perceptions of community objectives, "critical environmental needs," and alternative strategies for improving the environment vary enormously among communities and their leaders. The leadership for ghetto residents might seek better employment opportunities, other family income sources, better schools, elimination of delapidated buildings, and improved housing, while the leadership for affluent communities want handsome public facilities, physically attractive neighborhoods, and elaborate housekeeping and leisure time services provided with maximum efficiency to their citizens. Both may seek safe and healthy environments.

The word, "environment," by referring to everything around us, covers enormous territory. Discussions of "environmental management" often limit the subject to the physical environment, including air and water pollution, solid and liquid waste disposal systems, and resource recovery. Each of these are likely to be concerns of city managers and other local chief executives. Even while defining environment in the narrowest terms, one cannot ignore other interdependent features such as the economic health of communities and their capacity (people, legal, and financial resources) to combat environmental problems. Most, if not all, of the daily concerns of city administrators relate to some broadly defined aspect of the urban environment, be it routine city services operations, utility operations, community development, people-problem solving, or even funding policies.

Local administrators as chief environmental officer

Generally, local administrators have tended to act as the guardians of their respective municipal environments and might be described as the chief environmental officer for their respective communities. Traditionally, they have sought to improve urban environments mainly by providing better public "housekeeping" and beautification services, by seeking better public facilities and by working for more effective regulation through municipal codes enforcement. At other times, however, they have given priority to improving their communities' economic environment either by supporting road building, more highrise buildings, or industry. This has been done perhaps to the long-term detriment of the rural environment.

In general, local administrators tend to be pitted against special interest groups on behalf of the total community's interest. Other times, their efforts have been directed at citizen apathy or lack of understanding, and corresponding taxpayer resistance to pay for community betterment, as in the case of a bond issue for sewage facilities. Improving the environment, at the local level, depends on the difficult policy questions associated with determining who pays for what, when, how much, and for whose short or long term benefit. It is largely a matter of making the trade-offs vital to most political processes.

Obstacles to cleaning up

Managing the urban environment might be defined as securing the best

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*Charles T. Henry is City Manager, University City, Missouri. His article was prepared for this volume.

quality of life from the resources at hand. The local government administrator must contend with (1) financial obstacles; and (2) interjurisdictional problems; (3) legal inhibitions, rooted in state and local law; and (4) inadequate technology. Often these obstacles may be a matter of economics and politics. For example, "inadequate technology" may actually mean that local decision-makers are unwilling to pay the current price for existing technology.

Although confronted by numerous obstacles, the local government administrator is faced with expanding opportunities and obligations to meet the environmental challenges. First, the ecology movement, in addition to focusing public attention on possible future world-wide disasters, has contributed greatly to making "John Q. Citizen" aware of his own community's environmental deficiencies. Although this heightened awareness may have complicated the lives of many local administrators, their struggles for a healthier, more attractive, and nuisance-free urban environment have gained many new allies in the process. These range from "grandma ecofreaks" to eager school children seeking environmental projects. Public agencies at all levels of government and private agencies in various types of business activity are putting forth more funding for environmental programs than ever before. In order to meet the added burdens precipitated by this new movement, local administrators must seek out new resources, new organizational approaches, new procedures and programs. The remainder of this paper is addressed to such considerations.

Organizing local government

In true bureaucratic fashion (but with legitimate reasons) the initial response of many local administrators for meeting the environmental challenges may be a request for additional staff. Alternatives, such as creating new citizen committees or study commissions, are likely to lead to the same result with delays. Volunteer commissioners may give only so much of their time before they must request staff help. Moreover, many cities already have too many citizens' commissions dealing with overlapping environmental responsibilities such as beautification commissions, park and recreation commissions, sewer and water boards, public works boards, zoning boards, and planning commissions. Traditionally, the local administrator seeks to coordinate their activities through his staff which may be assigned to servicing these commissions. All too often he is refereeing their conflicts while trying to moderate their staff and resource demands.

University City, a St. Louis suburb of 50,000, some years ago created a permanent, advisory and coordinating staff position on environmental affairs. This person reports directly to the manager and is essentially a managerial assistant. Not the least of his duties has been that of first reviewing the avalanche of publications and reports on new environmental technology, new state and federal legal requirements, new environmental needs, and all of the management procedures and suggestions on these matters that come pouring every day into City Hall. Similarly he has to deal directly with newly formed local special-interest groups and citizens who are concerned about environmental issues. Increasingly, he has become engaged in a considerable amount of environmental intergovernmental contact.

His most important assignment is to evaluate the broad spectrum of city operations and facilities that relate to the most pressing environmental needs. These assignments include; reviewing the quality and nature of city solid waste operations, the status of air pollution and noise pollution conditions; researching possible improvements in procedures and technology within the city's available resources; developing school recycling centers in cooperation with the children and school staffs; researching pesticide control ordinances; and devising a better record system for environmental sanitary inspectors. This position thus serves as the first screening and evaluation center for local government policy and implementation in environmental affairs.

In many cities, lack of funding and political infighting may require the local administrator to assume the duties of environmental management himself. This is particularly true in smaller communities. In other cities, he may assign environmental responsibilities to existing positions in the governmental structure. In larger jurisdictions, several positions may be performing environmental control functions within a single department, and several departments may be deeply involved in environmental matters. For example, an electrical services department of a major city has to be increasingly concerned with such matters as air and noise pollution control equipment at its own generating stations, as well as fuel content, waste disposal facilities and beautification of plant environs. The more environmental responsibilities are distributed among several departments and the larger the jurisdictions, the greater become the problems of coordinating major environmental strategies. Concurrently, the need to coordinate activities from a chief administrator's office also becomes greater.

Environmental code development

The demands for a better urban environment tend to increase the volume and complexities of local, as well as state and federal, regulatory law. New environmental policy development in a municipality is expressed, in large measure, through revised city codes and ordinances. Apart from any federally imposed codes instigated under the old Workable Program requirements of the federal government, many municipalities recently have expanded and refined codes relating to the "environment" of private property. Control over "outside" environment is written into sanitation codes and in certain provisions of housing codes, both of which have procedures governing the removal and storage of solid and liquid wastes, derelict and unlicensed vehicles removal, control of weeds and high grass, dead trees removal, the paving and drainage of lots, overall control of litter on private property, and elimination or improvement of defective structures. Other controls have been introduced into zoning provisions, such as private landscaping controls, building size regulation, architectural design, sign controls, the undergrounding and placement of wiring, and various other attempts to minimize visual pollution. Community noise regulation in zoning and nuisance ordinances exist in relatively primitive forms. Many of these types of provisions are supplemented and reinforced through continual refinements in building code regulation for new construction of both residential and commercial buildings. Building maintenance codes, as distinct from building construction codes, are increasingly being enacted. More commonly known as housing codes, they are applied to both inside and outside elements of structure. Fire codes and heating and electrical equipment regulation codes for private buildings have grown in numbers and complexity in recent years.

Communities tend to adopt nationally recognized codes by references and utilize the experience of other jurisdictions as may be appropriate to their own situation. In some instances statewide codes requiring local enforcement have been enacted. City staffs, citizens' committees, and elected officials at the local level have borne the brunt of preparing most of this local government legislation. Managers often have difficult logistical problems in trying to supply the necessary information and the legal and technical resources, so that appropriate programs are formulated for adoption by city councils.

Code policy implementation

Substantial administrative changes have become necessary as a reslult of the growing body of code regulation.

These include increased staffing of specialist inspectors and legal assistants, as well as the development of specialized procedures and techniques such as elaborate record keeping systems. University City's sanitary inspectors routinely record litter violations by Polaroid camera, and issue summonses which are processed through the record system, ultimately to the court. In a given year, about 1,500 litter notices are issued by a staff of 2 to 3 inspectors, and about 10 percent result in court appearances. This same group of inspectors will record about 600 weed violations a year, thereby initiating a process of notices, city weed cutting, and ultimate tax billing. They are supervised through a radio communications network. The Police Department, in another highly routinized process, annually serves notices on approximately 500 unlicensed vehicles on private property, quite apart from those on public streets. An adequate record system must back up this process so that the 10 percent uncooperative violators can be prosecuted in court and action taken, even after court prosecution. With respect to housing and commercial building maintenance, in 1967 this city adopted an occupancy permit approach whereby, on any change of occupancy, the building and premises are inspected. Residences are brought within reasonable compliance before new occupancy is permitted. About 1,000 buildings are so processed each year, and some 10,000 violations corrected. About 250 court cases support this effort. A well organized staff of housing inspectors and administrative personnel sustain this operation, along with the legal staff for court prosecutions. Some 29 cities in St. Louis County alone have adopted this occupancy permit approach to control neighborhood housing and, in effect, the neighborhood environment. To operate such complex programs with equity and efficiency, constant training and vigilant supervision of staffs, backed up with adequate records and controls, become imperative. Also needed is a cooperative court system and an overall base of community support.

Legal enforcement of the code

Federal and state agencies have been securing acceptance of greater environmental regulation through a number of techniques ranging from public reports to court injunctions imposed upon both public and private organizations. They have had additional carrots and clubs at their disposal by offering or withholding funding grants, while imposing a wide variety of conditions on local governments, ranging from the preparation of environmental impact statements to requiring construction of sewage plants. Although some cities may be in a position temporarily to withhold certain services, such as electricity, water or refuse collection, enforcement must rely on local court adjudication. Nothing may be more essential to securing local code compliance than an administrator's capacity to bring violations into a local court promptly (in a manner of two or three weeks). Failure to do so on a rather consistent basis jeopardizes pending and future enforcement actions. Capability thus means having an easily accessible municipal court or an equivalent county or state court which is available and familiar with these forms of law and willing to participate. Regrettably, such conditions seldom exist without considerable stimulation due to the newness of many of these regulatory activities.

In the St. Louis area the need gradually is being met with the creation of municipal housing courts, which might be better termed environmental courts, since they deal with local government regulatory law on matters well beyond housing maintenance. The role of these, as any municipal court, is to secure compliance and not simply to impose fines or penalties. Thus, various forms of leverage such as suspended and conditional penalties and escalating penalties for repeating offenders, may be appropriately imposed. Although litter and many sanitation violations might be considered routine and easily processed, zoning and housing code violations are relatively complicated. Thus, prosecution staffs and the court judges may develop effective processing only after considerable experience.

Inter-departmental committee

As the multiplicity and complexity of environmental policing actions grew within University City, it was necessary to create a permanent inter-departmental staff committee. This need was dramatically illustrated by many earlier failures to achieve successful environmental (housing) court actions. All the administrative staff needed training in matters of court procedures, and the prosecuting staff in matters and purposes of the codes.

This intergovernmental committee consists of representatives from almost all major city departments and department heads, including the Urban Renewal Director. Other regular attendees engaged in regulatory activities include high level supervisors from the police, fire, public works, housing, zoning, building and forestry departments, as well as other staff representatives whose clients may be affected by such regulatory actions, such as those of the Human Relations Department. The weekly meetings are chaired by the city manager or an assistant. The legal department is represented by the prosecuting attorney and/or an assistant. Each case which is to be brought to court is reviewed, and penalties are recommended or other negotiations suggested as means of securing compliance now and in the future. The prosecuting attorney then tries the case in the environmental court and presents the committee's recommendations to the judge. Frequently, many different departments and divisions simultaneously handle a single property or single family, thereby resulting in a useful exchange of knowledge. Since its inception, this inter-governmental committee's purposes have been broadened considerably to include discussions of various strategies, such as improvements in city services.

Conclusion

The foregoing discussion focused on managing a predominantly developed urban environment. It represents a case study of selected actions for conserving existing urban neighborhoods, rather than providing an examination of managing expanding or high-growth environments. For example, in a high growth area, the environmental controls requiring most attention would be new subdivision regulations, the placement and nature of new public facilities, private and public land-use designs, and the community's overall comprehensive development plan. Plan Commissioners, planning staffs, and building and zoning inspectors would be among the leading local actors involved in these decisions. In contrast, neighborhoods already built would seek solutions to environmental problems by total obliteration and redevelopment.

The challenge facing local chief administrators begins with keeping abreast of the environmental movement and its ramifications so that they may assist councils and community leaders in decision making. The recent upsurge of environmental concerns certainly has forced local government officials to rearrange their priorities and the assignment of community resources.

II.6 Environmental decision-making

John Wentz *

I have organized my remarks under five sections. First, I am going to give you my personal definition of the scope of environmental management. We have had some difference of opinion already on what that ought to be. Then I am going to suggest at least one of several ways to organize to accomplish something. I am going to note some changes in city operations, which are being and should be caused by our interest in the environment, highlighting, of course, the Phoenix experience. Then I am going to comment about the strategy of balancing the pressures that city officials are under, both pressures for action, and pressures for restraint or no action. Finally I will give just a brief comment on what the future may hold.

Defining environmental goals

In defining the scope of environmental management, "life style" is perhaps the key term. It is the variable that we attempt to influence. Our objective is to enhance the quality of life style is affected by many things, such as law and order, welfare, jobs, salaries, and social programs. All of these are important, and do affect the quality of life. For my definition, however, we should for the moment restrict our concern to the physical, visual, sensory aspects of the world around us. At least with this agreed upon, we may then accept as a goal that one stated in the summary report by the California Governor's Planning and Research Office, entitled "Environmental Goals and Policy."

The overall environmental goal for California, "It states: is to create and maintain a productive harmony between man and his environment, the physical space in which he lives." The word "productive harmony" is important, because it does not mean all one direction or the other. It means a balance. Of course, it means the prevention of air and water pollution which we talk most about, as well as visual and landscape pollution. It means the use of management of our resources. Most important, it implies achieving a balance between the desire for quality of these surroundings, and a willingness to pay the bill.

Managing the environment, incidentally, is no different than managing anything else. It is simply applying conventional organization, research, education, and management practices to a new objective.

Organizational options

How does one organize to accomplish environmental management at a city level? There is no one right way; what works is correct. However, at least three elements are required in any organizational effort. One is enlightened citizen input; another is adequate staff. Third is interest and support of top management. If any one of those three is absent, we will probably fail.

Enlightened citizen input is needed for two purposes. First, it provides the ideas and support that you receive from the citizens, and perhaps more subtly, provides an opportunity for them to become educated themselves about the problem.

A staff should consist of at least one or more persons devoting full time to the problem. I think that the problem today has become important enough so that it cannot be solved out of the hip pocket of a budget and research department, or planning department. It needs the interest and support of top management. Nothing without that support will get accomplished.

In Phoenix we are still in the em-

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*Presented by John Wentz, City Manager, Phoenix, Arizona, at the National Conference on Managing the Environment.

bryonic stage, but moving, cautiously and deliberately, and with the full support of the mayor and the council. In July of 1971, the City Council of Phoenix, by ordinance, created a twenty-one member Environmental Quality Commission, with staggered three year terms, to function as a recommending body to the City Council, with primary duties to identify environmental problems. Their duty is also to recommend solutions of these problems to the Council. Upon careful study, this commission may recommend changes in regulations or policies, city procedures and programs, or it may hold public hearings to determine feelings of citizens. The latter is sometimes dangerous, but nonetheless, a useful device.

Making people aware

Another major objective of the commission is to create an awareness throughout the community of environmental problems and to encourage community cooperation in resolving those problems. The city planning department has created a staff environmental planner position to assist this commission in its work and to coordinate activities with the management staff. This professional staff member was hired through the Housing and Urban Development Comprehensive Planning Assistant Program. The direction for the enviornmental planner is very simple. It is to identify environmental issues, problems, and opportunities and to serve as an information source and contact point for city evaluation of environmental implications (including impact statements) and to facilitate the effective functioning of the citizens' commission.

The key to success will be the coordination of action to implement manager's office and the mayor's staff improvements or changes. The city will work closely with this commission, and assert sufficient thrust to propel the program through all departments.

Perhaps more important are some changes in the city operations caused by the current interest in the environment. When Phoenix addressed itself to this subject about two years ago, the first thing that we did was to examine what we were doing now that we had something to do with the environment. We found that we were already doing many things in the interest of environmental quality. I now propose to list these environmental activities in inventory form. For convenience I have organized these activities under the more or less responsible department.

With the aid of the planning department, the legislature recently passed the first state enabling legislation in the field of planning. This was a new accomplishment for us. It includes sections on the conservation element of natural resources and also a recreation element. It allows the establishment of flood-plain zoning and provides the municipality with power to reserve parks and recreational facilities within subdivisions.

In the planning department we have also adopted a number of hillside ordinances, which will control the quality of development of those hills that we are going to allow to be developed. We have developed three ordinances: (1) a grading and drainage ordinance; (2) an amendment to the zoning ordinance; and (3) an amendment to the subdivision ordinance, all of which control size of lot, or what you do, for example, with the cut and fill, steepness of driveway, and the runoff. The most important end result of these laws is to reduce the density. The developers, of course, bitterly opposed these regulations. However, they have been adopted.

Theory of density transfer

We have adopted the theory of density transfer in the design of PAD's —planned area developments. We allow a slightly heavy density in the flatland in return for keeping the hillside open.

We have gone into the sign business. That falls under visual pollution. We have stepped up our enforcement by doubling our fees and doubling the number of staff, starting a perpetual inventory, and requiring a bi-annual permit to maintain the inventory. We are cutting down rather heavily, for a large city, on signs. We are also studying amendments which may further crack down on the visual pollution from signs.

We are working very closely with the FHA in requiring back-up treatment for residential development so that we will have no more "Allen's Alleys" or those bleak backwalls along major streets.

Under the park department, we are working hard to develop a greater street-tree-planting program. Nurseries are being built in order to grow stock economically. Many of our street-tree-planting programs along major boulevards are purposely concentrated in the inner city area. What we call a slum looks pretty good compared to the eastern slum, even though for Phoenix it is a depressed area. Beautifully landscaped center strips and towering palm trees can be seen in this neighborhood as though it were on Sunset Boulevard. This type of improvement helps to raise the spirits of that portion of our community.

The most exciting thing we have done recently is to get into the open space program in a major way. In this regard we are indeed following the advice of the man for whom I am pinch hitting, Mayor Pete Wilson of San Diego, who has said:

> Land use really is the starting point of most of man's polluting activities. Land dedicated to park or open space makes a significant contribution to environmental quality in two ways. It is enjoyable both in itself and also for the relief it provides from other surrounding and polluting land uses. It may be that the greatest contribution cities could make to improve their quality of life is the acquisition of as many desirable parcels as possible, as early as possible, before land prices soar out of range or compel development and permanent loss of open space. The time is now—before it is too late.

The city already has the largest municipal park in the United States. It includes approximately 15,000 acres of mountain area and is called South Mountain Park. It is a desert park on the south end of the town. In the middle part of the city is a large mountain range called the Phoenix Mountains. For years people have been worrying about how urbanization would affect these mountains. It became perfectly obvious what was going to happen when people began to creep up the sides and build. If something were not done, it would soon become the Hollywood Hills all over again. We had a consultant do a study to determine what he thought might be done about this open space. He recommended that we preserve it, which was a rather simple recommendation although it will cost $40 million. It is all privately owned. We did not know how to cope with that, so we appointed a citizens committee. It consisted of 125 members, and was called the Phoenix Mountains Preservation Commission. Some people criticized the Commission because of its size. We broke it down into subcommittees, and eventually they developed a financing plan. They had a little help from the staff, but it was basically their own plan. They also came up with a plan for selling the idea to the community.

Rocks gain vast support

Recently the citizens voted by a two-to-one margin a $22.5 million bond issue to help buy those "rocks." We are pledging $13.5 million of our federal revenue sharing funds toward it. The rest will come from federal revenue sharing, which should continue past the first five years. We are starting out very aggressively to buy this 9,000 acre mountain range and have already spent about $3 million from accumulated funds. It will be an open preserve of pristine quality in a densely populated area.

On the west side of the city we are buying, with the assistance of HUD open space grants, land along a dry creek. Eventually this will be Cave

Creek Regional Park, a strip of land seven miles long with golf courses on former sanitary land fills and a variety of other open space uses. Beyond the present city limits to the north we are obtaining from the Bureau of Land Management large mountain areas which will eventually become regional parks. One such area of about 1,000 acres will be combined with a sanitary land fill of 900 acres to form, in twenty-five to thirty years, the Skunk Creek-Deems Hills Regional Park.

Another stimulating project is the current Rio Salado study under the auspices of the Maricope Association of Governments, our local COG. This proposes to develop the waste land along the normally dry Salt River for a distance of forty miles through the valley with recreation and economic uses.

Federal money for open space

Downtown, in the interest of open space, we are also spending some federal revenue sharing money to buy a downtown block, demolish a number of pawnshops, and make a Pershing Square out of it. It is the anchor of our governmental mall. We are also buying five blocks in the governmental mall, along with other governmental agencies, so that it will stretch from the city hall to the state capitol someday, fifteen blocks long, with an open green sword going down between. This project is striking a blow toward improving the environment, and we are having a lot of fun doing it.

In the water and sewer area, the city is improving the appearance of many of its facilities by painting and landscaping. Most exciting, however, are the experiments using the effluent from the sewage treatment plant. One project is funded by an EPA grant and is trying to determine, with the help of ASU, how we can purify the water somewhat more, so that it can be used for the purpose of irrigation of truckfarm crops. We are already selling 70,000 acre feet of our effluent to an irrigation district, which is using it for forage crops. We have not yet reached the point of using it for edible truckfarming crops.

Six cities, all using the same sewage plant as Phoenix, have agreed to sell the waste product from the sewage plant to the ANPP, which is the Arizona Nuclear Power Project. It will be the first nuclear power plant to use sewage as cooling water. That is a very productive use for sewage. In addition, we will receive between twenty and thirty dollars per acre-foot for it. That is probably the highest priced sewage in the country.

Under the engineering department, we are requiring contractors to dispose of their soil in landfill, instead of laying it over the desert (which is tempting, because there is so much of it). We are entering into an expensive service center beautification program. These centers house the refuse and street department trucks; we are landscaping them heavily. Our Omaha orange-colored trucks, which used to be thought desirable from the standpoint of safety, are being changed to desert biege so that they blend into the landscape. These are simple, little things, but they are all in line with the general movement. They give us a chance to score a few minor victories early in the game and to build up some momentum for the program.

In the city manager's office, we run an inner city neighborhood environmental improvement program headed by an administrative assistant in charge of our south Phoenix branch office of the mayor and city manager. He is coordinating activities of various operating departments on a block-by-block, boot-strapping basis, working through neighborhood councils of the city's CAP agency (known as LEAP), which operates as a department of the city in Phoenix.

Public support is vital

In summary, while some of these actions probably could have occurred anyway in the society twenty years ago, most of them are possible now only because of the tolerance and the support of the public.

For the strategy of balancing pressures for action and restraint, we need a check system for pre-analysis of the environmental aspects of all new projects. The potential environmental impact of a project must be determined before a project is built. We need a better, more objective cost-benefit analysis. This is the main issue in environmental protection. How much are you willing to pay to have the kind of environment you want? We need more citizen involvement, certainly far beyond the commission. Several area planning councils have been established in our city, and they are very active, not only in planning their areas, but in environmental concerns.

We are working through our neighborhood councils in the depressed areas. We believe that the people in the disadvantaged areas have just as great a stake in the environment as anyone else. One of the greatest problems is understanding the alternatives. For example, we have a freeway problem in our city. In a recent poll, people voted to abandon a freeway which was ten years in the planning. Nobody in the community thought seriously about possible alternatives, but they have decided against the freeway. Now we have the problem of a massive educational program of trying to determine how to preserve our mobility.

How do we cope with these two pressures? Pressures for precipitative or unreasonable action are offset by strong organization and objective research and analysis. Pressures for restraint are offset by good education and good citizen involvement. It is a delicate balance, but those of us at the local level are experienced, or should be, in maintaining that delicate balance.

What does the future hold? The environmental issues will remain. The only question is: what action are we going to take? Interest will remain high. The management of the environment will become more realistic and more down-to-earth as accomplishments prove successful, as we achieve some minor victories along the line of the Lindblom theory of incremental approach.

A touch of pragmatism

The involvement of pragmatic administrative officials will balance the enthusiasm of impractical activists in order to achieve a productive balance. We are not going to return to caveman life. The era of growth, expansion, and exploitation is peaking. The era of consolidation, of polishing off the rough edges, of emphasis on improving the life style, is on the rise.

It behooves government and industry managers to pay attention to these indicators. They must and will be in the forefront of action programs for two reasons. First, to balance the unrealistic emotional demands of certain members of the society and second, to ensure that something really gets done.

II.7 Planning for quality growth

Shelley M. Mark *

Hawaii is the newest, one of the smallest, and probably the most environmentally fragile State of the Union. Because of its fabled climate and natural beauty, Hawaii is a prime attraction for tourists. Because of its strategic central Pacific location, it is a major military outpost. Because of fortuitous combinations of climate and soil, labor and capital, research and technology, it has supplied world markets with sugar, pineapple, and other tropical products. With this obvious interdependence between economic prosperity and environmental quality, Hawaii has long been concerned with protection and enhancement of its environment. Because of its small size, the threats to both environmental quality and economic life-blood are more readily recognized and preventive action more easily galvanized. Because the State is new (14 years old), it is not hampered by age-old structures, practices, and traditions, and is more apt to venture into pioneering approaches to solution of environmental problems.

The Hawaiian land-use law

Hawaii's pioneering has been recognized nationally among specialists in land use control. In "The Quiet Revolution in Land Use Control," a major national survey prepared for the U.S. Council on Environmental Quality (December 15, 1971), the authors, Fred Bosselman and David Callies, wrote:

> "It all began in Hawaii. The quiet revolution in land-use control saw its first legislative success with the Hawaiian Legislature's passage of the Land Use Law in 1961. In the initial years after its passage, mainlanders typically brushed it aside as a strange phenomenon from a strang land. But now as other States begin reform of their land regulatory systems, it is increasingly apparent that Hawaii's ten years of administering a system of Statewide controls offers a valuable source of practical experience."

Hawaii's Land Use Law was itself a direct outgrowth of the nation's first State General Plan and remains an integral part of the State's planning and environmental management process. It was passed in response to certain worrisome environmental trends in the period just prior and subsequent to our attainment of Statehood. The State's usable lands are extremely limited; our prime agricultural lands were facing pressure from urban sprawl; scattered developments and speculative subdivisions raised questions of public costs vs. private benefits; the necessity to protect our shorelines and other scenic assets, our forest, water and other natural resources was clearly recognized. Thus, the Hawaii Land Use Law sought to preserve prime agricultural lands, to guide urban growth for more efficient use of public services and facilities, while permitting reasonable housing, commercial and industrial expansion, to establish a system for prudent management of our environmental resources.

The Land Use Law provides for a State Land Use Commission appointed by the Governor and confirmed by the Senate. The Commission is authorized (1) to classify all public and private lands in the State, in one of four classifications—urban, rural, agricultural, and conservation, (2) to establish specific boundaries for each classification throughout the State, (3) to revise

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*Presented by Dr. Shelley M. Mark, Director, Department of Planning and Economic Development, State of Hawaii, at the National Conference on Managing the Environment.

these district boundaries on the basis of a petition and hearings procedure or a mandated comprehensive review every five years, and (4) to prescribe general uses permitted in each district—with detailed uses in the urban, rural, and agricultural districts to be administered by the counties and in the conservation district by the State Department of Land and Natural Resources.

Extensive data available

Today, the State has detailed maps showing precisely which lands are in each classification. These district boundaries must be reviewed comprehensively every five years. Preparations for the next review in 1974 are now under way. The Land Use Commission also operates under specific regulations intended to clarify and implement the law.

Thus, we have had a State Land Use Law in effect for the last eleven years and a Land Use Commission for approximately the last nine years. What have been their impact and effect on the growth of our community and quality of our environment? As in most public and controversial bodies of this type, there have been opposing views and differing interpretations. At the time of the last mandated five-year boundary review in 1969, the planning firm of Eckbo, Dean, Austin and Williams of San Francisco noted these positive results: (1) the State Commission has been stricter than the counties in approving petitions for rezoning; (2) scattered development—with one or two notable exceptions—had largely been brought to an end; (3) speculative subdivision of new lands beyond the need for new home sites had been greatly reduced; and (4) prime agricultural and conservation lands had been protected from urbanization.

Critics, however, have been concerned about continuing conversion of agricultural lands, especially the most highly productive ones, into urban use; speculation causing land and housing prices to rise while lands are withheld from use; and instances of a lack of coordination between State and county decisions, and between State zoning and State real property tax assessment practices. Issues have not been resolved, but the various attempts over the past decade to have the law repealed have been roundly defeated, while a number of key amendments strengthening the powers of the commission have been passed. This is not to say that the commission is one of the more popular institutions in the State.

Role of State planning in land use regulation

Our recent experience has emphasized that a State land use control policy can only be effective as part of a comprehensive planning program which embraces social, economic, environmental, administrative, and financial aspects. This planning has to be long-range, and requires coordination and interaction of functional plans by governmental and private agencies in order that the community's total resources be used to meet the needs of its citizens in optimal fashion. There is a strong need for comprehensive planning at the State level not only to examine and evaluate such functional plans (e.g., transportation, agriculture, recreation, education), but also to provide new insights, new directions, new information, new programs, and new methodologies for State government generally. Without this solid grounding in a comprehensive planning process, the flexibility deemed desirable in land use administration may easily become merely expedient, ad hoc actions.

The paucity of State general plans or of viable State comprehensive planning processes, however, indicates serious political obstacles not only to planning implementation, but to the concept of centralized planning itself. Thus, State planning agencies have been preoccupied with the search for relevance—for organizational structures or roles which may assure their existence amidst ever-changing Federal guidelines and ever-restive local jurisdictions. The end result of the State planning exercise has been to place the State planner in the Governor's office without either one knowing exactly what he was supposed to be doing there. In Hawaii's case, a relatively strong centralized government facilitated the passage of appropriate enabling legislation and the working out of administrative procedures necessary for the redistribution of traditional zoning powers. In the general case, this should not pose an insurmountable obstacle, since it is axiomatic that if a State can *delegate* its police power to regulate private land use in the public interest, it can also *exercise* it. The serious interest of a growing number of State and national officials in the Hawaiian experience, along with the expected passage of a National Land Use Policy act, suggests the sort of change in public climate which is necessary for any such exercise of power to occur.

States and the new federalism

The National Land Use Policy Act has been hailed as a principal means by which state and local governments will be assisted in making the transition from a chaotic crisis-by-crisis approach to a decision-making process based on a rational long-range planning. This may yet be, although the measure in its current form does not move strongly in the direction of a "national policy" on land use. There are few national goals or guidelines, and the economic sanctions originally designed to compel compliance with the measure have been weakened. One possible outcome of the Act might be the emergence of fifty state variations of national land-use policy.

The Act seeks (correctly) to build up State planning capability by providing funding, staff, a data and information base, and appropriate authority. Its approach is to focus available resources and expertise on "critical areas and uses of more than local concern." In so doing, it excludes existing incorporated areas in each State, which exercise often crucial planning and zoning powers, thus limiting its applicability. As the Hawaiian experience has demonstrated, land-use policy needs to be long range in concept and application, and the planning upon which it is based should be comprehensive in scope and jurisdiction.

The Coastal Zone Management Act of 1972 makes state governments the focal point in a related strategic area of environmental management. While the legislation does not require State participation, the prospect of Federal funds, as well as the privilege of requiring Federal projects and permits to conform with State management programs, are strong incentives. Without an approved state plan, Federal agencies could start projects without state approval. The law gives considerable freedom to the States to do as they wish in coastal zones, but what they do and how well they do it will depend on how quickly they can firm up their planning capabilities and how willing they are to tackle directly the complex problems of interjurisdictional management.

Another example is the proposed special revenue-sharing Better Communities Act of 1973, which purports to strengthen the hand of state governments and governors, while at the same time providing for the bulk of funds to flow to cities and urban counties. Congress is concerned that these funds may not be used in ways responsive to national priorities, such as housing, and that States are being required to administer programs without the benefit of national growth policies. The net effect may be to give States certain added responsibilities, without providing them with the effective authority to carry them out.

There are numerous other elements of the New Federalism that I cannot touch upon. Nor does it seem appropriate to resurrect or renew the debate on whether it is indeed the way to solve the complex social and environmental management problems. For those interested in this issue, a recent New York Times column by Professor Henry Steele Commager states: "The notion that voluntarism and local authorities can deal effectively with the national and global problems which crowd about us is without support in logic or history" and concludes: "Only the national government has the constitutional authority, the financial resources, the administrative talent and the statesmanship to deal with these problems on a national scale."

Time for state action

These matters have been and will be decided at a higher level than state government by the interplay between the national administration and the Congress. While the debate continues and new legislation and guidelines are hammered out, the states have the opportunity to use the period of "creative pause" to solidify the character of their planning and develop their own initiatives in order to come to grips with the forthcoming programs.

The National Land Use Policy Act, the Coastal Zone Management Act, and the Better Communities Act urge states to take the first steps (for some) in this direction. The challenge to the states is whether they can build up their planning capabilities and develop their planning processes in order to deal with their most critical environmental management problems in a far-sighted and comprehensive manner. The mandate to the Federal government is not simply to satisfy itself that the states are doing this, but to coordinate its own divergent planning interests and set forth goals and guidelines appropriate to a true national growth policy.

Nevertheless, the states now have at least the opportunity, with Federal statutory and financial support, to set their own directions, and to delve into the bewildering complex of local jurisdictional problems that have hampered rational environmental and land use decision-making in the past.

In the past, state planning has been preoccupied with its search for relevance—for systems, structures and roles to insure its continued existence. For the future, state planning must start building substance within structure, and directly face the environmental issues people are concerned with, no matter how difficult the task and unpromising the early returns.

Planning for quality growth

More than a decade ago, the people of Hawaii concluded that land is what matters, ultimately and environmentally. We passed our State Land Use Law, reflecting this realization and the desire of our people to establish rules and priorities for the use of our very limited land resources. The law was an outgrowth of these needs and its administration is an integral part of our comprehensive state planning process. In recent years our land-use controls and planning process have become increasingly intertwined with a variety of policies, programs and projects which have as their common focus the quality growth of our State.

Public concern with quality growth has, of course, long preceded the recent legislative actions and popular discussions on the subject. In the case of *Berman* v. *Parker* in 1954, Justice William Douglas wrote: "The concept of the public welfare is broad and inclusive . . . The values it represents are spiritual as well as physical, aesthetic as well as monetary. It is within the power of the legislature to determine that the community should be beautiful as well as healthy, spacious as well as clean, well-balanced as well as carefully patrolled . . ."

Following perhaps from Justice Douglas' suggestions that "it is within the power of the legislature to determine that the community should be beautiful," the 1972 Hawaiian State Legislature passed a law, mandating that a Quality Growth Policy be developed for the State by the Chief Executive. This legislation was also a key recommendation of Stewart Udall's Comprehensive Open Space Plan and an outgrowth of his feeling that a meaningful open-space program for the State could only be developed within the context of total environmental quality, with full consideration of population policies, urbanization patterns, resource uses, transportation alternatives and other man-made growth factors. Hence, the legislative mandate to halt urban sprawl, preserve open space, protect and enhance the environment of Hawaii and uplift our quality of life through the identification and implementation of fundamental State growth policies.

Laws are only a first step

However, the passage of legislation does not assure quality growth in a state. It is a necessary first step; it provides the structure, but substance has to be provided within the structure before a government can effectively come to grips with its most pressing issues of environmental management. This is what state planning is all about, and this is where the states may seize the initiatives and opportunities promised them under the banner of the New Federalism.

Accepting quality growth is a proper focus for carrying out the mandates under the new Federal legislation; it is then possible to outline the main elements of a state planning process designed to achieve it. These include: (1) definition and standards of measurements, (2) identification of principal problems or issues, (3) addressing these issues in a systematic, comprehensive, and far-sighted manner, (4) devising the instruments appropriate to the solutions required, and (5) gaining popular understanding, acceptance, and support for both the process and its recommended solutions.

While quality growth is difficult to define or make operational, it is nevertheless a useful disciplinary concept. Generally, it suggests multi-dimensional growth that achieves a socially desirable balance among economic, social, and environmental elements. This is in basic contrast with "quantity growth" which emphasizes growth along traditional economic and population dimensions. However, it is incumbent on each state to develop its own, unique, operational definition of quality growth, which emphasizes local attitudes and priorities with respect to the appropriate balance between economic development and environmental protection.

Basic obstacles to developing a state policy

Several basic problems must be overcome in attempting to develop a state quality growth policy. They include:

(1) arriving at a consensus on the appropriate balance among economic, social, and environmental objectives;

(2) achieving sufficient control over the rates and kinds of growth to be able to direct them toward a desirable balance; and

(3) gaining knowledge of the system which will allow us to predict the effects of our actions on different growth dimensions.

The major difficulty, of course, is that our system may be too "locked in" on quantitative, economic growth to be able to redirect itself toward quality growth. That is, economic and political self-interests are too tied into the present pattern of growth to allow for change.

The formidable challenge would be to devise a widely accepted policy, comprehensive planning process, and authoritative management program to break open these locks (to use a poor Washington analogy). Since quality growth is a change-oriented concept, a quality-growth policy or planning process must also be change-oriented. At present no clear consensus exists on precisely what quality growth is and how it is to be achieved; hence, a planing process built around this concept cannot be rigid and inflexible. The process must be incremental and concerned with asking questions about growth and increasing our ability to deal with these questions and make decisions about them. Thus, the process must be "experimental" where feasible; it must be constantly generating new ideas and testing them.

The states will need to build or rebuild their planning information bases. Decision-makers need to be informed and pressed with the questions suggested by the concept of quality growth. They need to be apprised of the impact of different decisions. We can best build this information base by careful planning studies aimed at specific, manageable policy questions. As consensus is reached and our information is broadened, we can then increase the scope of our efforts. We cannot be overly comprehensive and still produce timely and useful plans and studies at the same time.

The key: control development

As much of the impending national legislation suggests, physical development controls will continue to be the major means available to government for implementing growth policies. These include land use controls, capital improvements programming, environmental quality standards, and actual public participation in the development process. Raising the quality of the manmade environment will require that government form a more effective partnership with the private sector in the development process.

Using environmental impact statements

Controls of some type are needed to force consideration of the full range of impacts of government policies and actions and private and public developments. The only available device of this type is the environmental impact statement. The rationale underlying the EIS procedure has generally been that the EIS was only a first step that would lead to other institutional changes designed to give greater weight to environmental considerations in decision-making. However, the changes have been slow in coming and the EIS is becoming an end in itself. What seems desperately needed also is an EIS on the EIS, which would relate it to the state planning process and provide harried readers with better criteria for judging whether they are good or bad.

The pragmatists will say the concept of quality growth is too elusive, that the means of attaining it are too obstructed by immutable self-interest, and that we lack the information, know-how and techniques to achieve our goals. Perhaps the way out is for each of us in planning and environmental management to broaden our perspectives further.

Governor John A. Burns offers us a clue in his 1973 "State of the State" message to the Hawaii Legislature: "At the heart of it, the central element in 'quality growth' is a social one: It involves *people*. It means the creating and improving of Hawaii's economic and social conditions so that *all* men, women and children in our Islands can retain the full sense of their human dignity and proper pride, through meaningful employment of their God-given talents and the pursuit of worthy personal objectives."

This is a broader view of "quality growth" than is customarily found in discussion of the environment. Perhaps there has been too narrow a perspective which sees only physical dimensions, urban design, the ideal placement of buildings, and preservation of open space. Perhaps the nation's concern about environment has put too much stress on capital improvements, city plans and economic plans and master plans and general plans—which limit our vision to the physical and economic elements of "quality growth." The new vision is to the growth of the human person, in an environment which he both shapes, and is shaped by. It is the only environment he has, and one which must bring him happiness and fulfillment. Quality growth through intelligent planning contributes to that goal.

II.8 Next big industry: environmental inprovement

James Brian Quinn *

The often strident cries of the "environmentalists" have raised a fundamental challege to the private enterprise system. Questions like these are basic concerns for all:

- Can a free society have both a high standard of individual wealth and a clean environment?
- Is the private enterprise system capable of providing those elements of "an improved quality of life" which represent public—rather than private—demands?
- Can industry meet environmental demands yet maintain its capacities to compete internationally?

I believe private enterprise cannot only meet the challenge but thrive on it. To do so, however, requires some basic rethinking of the whole environmental issue. The following ideas are basic to this reconceptualization:

1. The demand for environmental improvement offers opportunities to nearly all types of companies to share in huge untapped primary markets.
2. Properly developed, these markets will create economic growth, which can pay for many of the environmental improvements sought.
3. Much of what appears to be "the national cost" of environmental improvement really represents new markets created by unfilled public demands.
4. Business and public policy should focus on: (a) developing these markets rationally, and (b) minimizing the real overhead costs of environmental improvement; i.e., unproductive bureaucracies, improperly established standards, unnecessary dislocations, and ineffective public expenditure systems.
5. It is not enough to approach environmental improvements as a "business responsibility." Fair and well-enforced national regulations, sensibly developed public-market mechanisms, and fiscal policies which support intended growth and investment patterns will be essential.

For purposes of this discussion, I use the term "environmental improvement" in its broad sense—to include not only such matters as cleaner water and air but also safer highways, healthier communities, and a better-educated population.

Creating public markets

Our private enterprise system has developed the capacity to satisfy almost immediately the most detailed demands of any consumer, household unit, company, or institution in which a single authority can make purchasing decisions and has independent access to funds. But the system has been considerably less adept at developing and filling demands for public consumption and investment—hospitals, schools, water supplies, sewage systems, roads, parks, airports, waste disposal systems, and so on. If such public markets *could* be developed by private enterprise, however, they would provide exciting growth opportunities for many industries and simultaneously ameliorate many pressing social problems. For example:

- To clean up a river—and the shorelines and beaches it affects—requires sewage treatment plants, heat transfer units, cooling towers, waste and by-product processing units, improved storm drain and sewage systems, so-

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phisticated monitoring apparatus, and so forth. These, in turn, create supplier markets for steel and metal products, construction equipment, pumps and treatment equipment, meters, switches, wire, electronic controls, construction materials, glass, ceramics, plastics, and chemicals in profusion.

This example suggests that demands for "'a cleaner environment" or "a better quality of life" could create new or expanded markets for almost every industry—no matter how basic.

How do public markets come into being? They may be produced by (a) aggregating individual demands through public expenditures, and/or (b) forcing individual action through regulation or tax policy. Let us examine each of these forces in turn.

Aggregating demands

In some—but by no means all—cases, government bodies have to aggregate and dispense funds to purchase items individuals cannot afford. Refuse, sewage, transportation, education, recreation, and public safety systems would all fail in this category.

Can such expenditures result in net growth for society? Some traditional economists might argue that tax-financed public expenditures only transfer funds from one source to another—and consequently cannot provide net growth. But past experience does not support this view. For instance:

- In recent years publicly financed interstate highway systems and subsidized aircraft development have stimulated the growth of public travel, trucking, airlines, transportation fuels, and other related industries.
- The U.S. space program created a whole new market never previously conceived.

Environmental improvements could have a similar effect. Economic growth occurs whenever a society begins to commit energies and resources to fulfill "felt needs" beyond those it has been able to or willing to fulfill in the past. Almost all society's needs—beyond minimum food and shelter—are psychologically based. People need vacation homes and skis because they *think* they need vacation homes and skis. Similarly, as people begin to *think* they want an improved environment, this demand can be converted into a series of new markets. These markets merely require public—rather than private—action to aggregate and channel the resources needed to satisfy the demand.

Although the American consumer seems to have an extremely high capacity for absorbing ever more intricate trinkets, many consumer markets are approaching saturation—with growth essentially linked to population growth. By contrast, markets for improved public well-being seem remarkably unsaturated. Consumers are ready to spend much more in these areas. In addition, most forecasts show non-defense public expenditures increasing at a more rapid rate than private consumption. In fact, public markets probably offer the fastest growing primary markets of the next two decades. The real problem is to develop these markets so they contribute to national growth, and well-being and do not become endless "resource sinks" without significant social gain.

Potential of regulations

Properly administered, government regulations and standards can expand market opportunities. Obviously, the television and radio industry could not have developed without standardized signal patterns, regulated frequency allocations, and safety regulations for receivers. Individual companies had to change practices that initially appeared to be in their own self-interest, but they ultimately gained because their total markets expanded. Similarly, regulations of the Food and Drug Administration and the Department of Agriculture forced all companies to meet product quality and safety standards that some producers found objectionable. But such regulations helped create the consumer confidence that was essential to mass markets for most packaged foods, drugs, and household products.

Can this pattern also apply to currently proposed social and environmental regulations? I feel it can. Consider the following possibilities:

- When electric utilities install air and thermal depollution equipment, their rate bases need to be increased (to maintain their return on investment), thus allowing higher prices, dollar profits, and taxes. Power use for installed capacity is quite insensitive to small price changes, especially in the power-short East, where pollution is worst. Consequently, power companies, construction groups, and depollution equipment suppliers all gain (and pay increased taxes). And jobs are created in the area, with corresponding multiplier effects on all household and consumer items—including electric appliances.
- More stringent radioactive emission and waste disposal standards—which recent cases indicate nuclear producers can already meet—would increase confidence in atomic power plants and thus expand the market for them.

In short, the net effect of government regulation can be to express, through political processes, fragmented demands that individual consumers cannot effectively express in the market-place. Proper regulation can create new primary markets which contribute to national growth in the same way as a new product innovation. Just as television satisfied a latent demand for visual home entertainment, safety and depollution devices can fulfill latent demands for personal health and other intangible "qualities of life." Effective regulations simply aggregate these demands to a sufficient level to call forth the productive resources needed to satisfy them.

Needless to say, all government regulations affecting products and services do not create new market opportunities. They certainly do not if standards are developed, administered, or enforced in an illogical or haphazard manner. The point is that the *potential often exists* for regulation to increase total market opportunities, rather than to hinder or thwart real economic growth. But government and industry action is necessary to bring out this potential.

Costs vs. markets

Clearly, improved environmental quality and public services are not free. What portion of proposed expenditures consists of self-supporting new markets? And what portion is really an increase in national overhead?

There is no question that each sewage treatment plant, air scrubber, or cooling tower represents a cost to its owners—as opposed to dumping waste into the environment. This is why so little action has been taken in the past. How, then, can depollution be anything but an added cost to society?

Environmental improvement can create self-sustaining domestic markets for better health care, housing, education, transportation or depollution systems. If people really want such benefits, they must be willing to pay for them just as they would pay for hair styling, mod clothes, or snowmobiles.

But can the values of growth more than offset the overhead costs of (a) collecting and dispensing needed funds and (b) regulating industrial practice when necessary? Assuming that our society has underemployed human and fiscal resources, each additional person employed in a new or expanded industry creates three or four new jobs in service and support industries, including retail and wholesale trades. If each of these people and their employers are paying taxes, it is not hard to see that the additional revenues from these groups alone could pay for the overhead costs of their industry—and, indeed, for a large portion of the new services themselves.

Add to this the employment and innovative effects of a generally higher demand level, and enough expansion could occur to exceed *all* of the costs of new public markets.

Serving the public market

Under the specified conditions, the industries serving public markets become self-sustaining. Buyers pay the full cost of the benefits they receive, and the new industries do not become a drain on other sectors. It is plain fallacy to state that if people choose to spend part of their incomes on parks or health, this will somehow increase the cost structure for steel or chemicals. Even when the regulatory approach is used—for example, in depollution—buyers, not producers, ultimately pay the cost of services demanded. Producers actually have an opportunity to sell a product with greater value added; i.e., their product *plus* environmental improvement—just the kind of opportunity most are normally seeking.

The growth process just described is not immutable, of course. Two assumptions are vital: (a) the demands expressed through public purchases or pressures must be stronger than those substituted for; and (b) there must be some slack in the economy, i.e., some underemployment of people and capital. Otherwise the new industry would merely take away from one or more existing ones, and no real growth would result. But even when resources are limited, the public can increase the value (or utility) it receives—if it substitutes marginally important public purchases for less desired private consumption.

Note, that added capacity usually *is* available. There are unemployed people who want and are able to work. There are employees who, with training or better management, could become more productive. Investments could be made in new technologies that would free employees for work in other areas; and so on. So long as conditions like these are present, the environmental-improvement industry can add to GNP as other new industries have in the past.

Sizing up the costs

Actually the nation is already absorbing many costs that would be eliminated or reduced with environmental improvement. Polluted riverbeds and estuaries cause reductions of fishing, recreation and housing-development potentialities that may be greater than depollution costs. Air pollution leads to physical plant depreciation, acidification of soil, cleaning bills, personal discomfort, and deteriorated health. And inadequate air traffic systems cost millions of dollars in personal delays and extra equipment operating costs, not to mention human life.

All of this is little comfort to the company, community, or individual who must suddenly pay the cost of a new depollution system. If a unit has capital, it could presumably devote its funds to purposes that yield more direct and shorter-term gains. However, many companies—including some prime producers of toxic effluents in the air—could pass depollution costs along, with little or no negative impact on profits. And many basic processing companies have found that they actually save money when forced to innovate in response to environmental controls. To illustrate:

- American Cyanamid Company is using new processes in Polk County, Florida that return ecologically harmful and unsightly phosphate strip mines to usable purposes, yet reduce costs by as much as one third.
- Dow Chemical Company recently reported that to date it has almost always found ways to lower costs when it improved effluent controls.

In many industries *primary* demand is relatively unchanged by small industrywide price changes—although similar price shifts by any one producer could cause a substantial shift in *selective* demand. In such cases, minor cost increases caused by depollution or safety regulations—applying to all producers—could be passed along in prices with a negligible impact on individual producers. Even in industries with higher depollution costs, demand shifts may be limited if there are no feasible substitute products or if functional competitors' costs increase by a similar amount.

Nevertheless, there will be some very real costs as society shifts its energies to environmental improvement. The following seem to be most important:

1. *Lower growth in private demand* for certain goods and services will undoubtedly occur in the short run.

2. *Displacement costs* can hit individual companies or communities hard.

For example, marginal companies in small towns may lack the capital needed to meet new regulations.

3. *Small price changes* may seriously affect some industries' primary demand. This occurs when another product or service can be easily substituted for the one in use—for example, coal for oil in power plants. In these cases, sizable industrywide displacements could result from increased investments or operating costs due to new standards. In time, this displacement would be absorbed by the growth in the industries with the substitute products or services.

4. *Government bureaucracies* could become an expensive result of environmental-improvement programs.

Softening the blow

The first three costs are merely characteristics of a market economy undergoing a demand change. If we really mean to have a market economy, the consequences of shifts to public demands should be accepted in the same vein as private consumption shifts. And the temporary distress these changes create can be relieved in familiar ways, such as stretching out the impact of the change, providing temporary tax relief, imposing short-term quotas, or helping communities injured by industry displacement. All of these have long been standard tools of public policy.

But, as soon as possible, such supports should be dropped so that each industry and company is competing on its own merits and absorbing its full costs. Society must ultimately pay—through higher prices, if necessary—for the added demands it places on producers. In a market economy the impact of these choices should be distributed through industry by the price mechanims, with each company and industry absorbing the full cost of its existence.

International competition poses some special problems. For example, although the depollution industry could become self-sustaining on a domestic basis, individual producers' costs could increase vis-a-vis competitors in foreign countries with lower environmental standards. Foreign products shipped into the United States would, of course, be subject to U.S. product standards (e.g., automobile safety). But lower production costs—from more lax pollution standards—could allow equivalent foreign products to enter with a price advantage. And U.S.-made products would face similar price disadvantages in most overseas markets. The net impact on U.S. balances of trade and payments would undoubtedly be negative in the short run.

The problem is very real and should not be minimized. Still, it is mitigated by several factors. For one thing, a number of important U.S. companies overseas have production bases that can help them to relieve these cost disadvantages. For another, some of the industries most affected by environmental-improvement costs—for instance, electric utilities and basic process industries—are either not large exporters or are insulated from foreign competition by high transportation costs. Also, many important exports—like high technology products—should be relatively unaffected by environmental costs unless basic materials represent a high percentage of their cost. Finally, some U.S. antipollution devices and processes should become highly salable exports in themselves.

Another alleviating factor is that foreign countries too are becoming highly sensitive to ecological needs. Effluent charges have long been used along the Rhine river. Great Britain is now implementing a program for cleaning up the Thames and other rivers by means of better effluent control; Italy has drafted legislation that will control the pollution of its inland water systems through the construction of purification plants; and Sweden now requires new plants to incorporate the latest technology for pollution control. There are many other such examples.[1] Actions like these will certainly help equalize international competition.

Nevertheless, some U.S. industries will doubtless need temporary quotas, tax relief, or other protection. Multinational agreements on "off-sets" for relative pollution standards seem too difficult to achieve within the time span needed.

Restructuring the markets

In this country, there has long been a demand for improved refuse, sewage treatment, transportation, medical, educational, housing, and recreational systems. More recently the public has demanded industrial water, air, effluent, and safety systems. However, these demands have not been converted into effective markets that producers can sensibly anticipate and serve. No one can now predict exactly how these markets can ultimately be best structured.

In many ways today's public market mechanisms are as undeveloped as consumer mass marketing was in the 1890's. But given a proper outlook, industry and government can together develop needed solutions—just as they evolved the social innovations that permitted mass private markets. Let us examine some of the main problems and most encouraging current trends.

New political units

Precinct, town, county, and state units provide the electoral base for politicians and the funding base for taxation. But the boundaries of these units bear no relationship to today's public purchasing or regulatory problems. For example, water depollution may require consistent policies for a multistate river basin; air pollution abatement may require coordination on a broader regional basis; and so on. Our traditional political units complicate the processes of: (a) obtaining popular support for taxes needed on a regional level; (b) standardizing systems, components, and building specifications to achieve scale economies; (c) developing administrative units to oversee and/or manage regional expenditures; and (d) setting priorities among programs at a regional or national level.

But recently a new level of quasi-governmental "authorities" has evolved to coordinate action on specific functions or problems throughout the areas they affect. These authorities include river basin commissions, air quality agencies, regional transportation commissions, emergency service coordinators, port authorities, and so forth.

Although not completely effective now, these regional bodies may eventually provide a much-needed decision mechanism for many new public markets. The big questions are whether they will be properly funded and whether they can force a reasonable degree of uniformity and coordination on local political units. If Congress uses these regional bodies to enforce national standards, and channels the bulk of its environmental funds through them, they could have enormous impact. Many county and state regulatory and purchasing functions could diminish in importance or disappear. And new mechanisms would be necessary for people to adequately express their preference on priorities for the regional authorities themselves. This poses formidable problems.

Improved political practices

Political decisions often seem to be keyed more to creating local headlines or maintaining power positions than to solving problems. Legislators frequently support this year's flashy ideas—the ones with high current visibility or emotional content—while prosaic tasks with a higher pay-off limp along. These fads often move too rapidly and inconsistently for industrial suppliers to risk development funds on them or to effectively plan other needed responses.

The problem is especially perplexing in new fields of government action like this one of environmental improvement. For a company to make the required long-term commitments, it needs some real assurance of long-term consistency in government regulations or fiscal support. Some answers to the latter may lie in trust funds, effluent fees, and fee-for-service pricing by public corporations. Although still experimental, such devices could provide relatively independent long-term financing for specific environmental improvements. Such funding, effectively administered through professional regional authorities, could eventually decentralize public-spending decisions to the degree needed to assure rational public markets.

Poorly formulated political standards have also been counterproductive. For example:

- Many informed observers feel that Congress' decision to move 1980 auto exhaust standards ahead to 1975 was made with inadequate recognition of some very serious technological problems faced by manufacturers. It may well be technically unfeasible to meet these standards without prohibitive price increases or solutions that markedly *increase* fuel consumption. Automotive company protests were ignored because Detroit had lost credibility during its earlier protests against pollution standards.

Actions like this erode the confidence of all parties and make rational progress difficult. Companies become defensive and will promise nothing in the fear that politicians will always demand more. Government agencies become frustrated by company intransigence and confused as to whether standards are real or merely strawmen. And the public becomes cynical as promised standards are never met or enforced.

Political factors will always enter regulatory and public expenditure decisions. But more thoughtful business leadership could (a) anticipate and avoid many crisis situations, and (b) actively stimulate programs that offer growth in markets and public well-being.

Better public management

Ineffective administration and poor planning have often overwhelmed well-intended public programs. Early public housing programs are a case in point. Individual programs often destroyed more existing housing than they created. Currently the negative "second order consequences" of fertilizer, insecticide, "green revolution," superhighway, and welfare programs have been astonishing.

There is a great need to manage public expenditure programs better. Especially, new methods must be developed to measure the overall performance of regulatory and purchasing agencies and their subunits. Without such measures public administrators must follow costly, detailed contracting and internal control procedures that make it difficult to pinpoint responsibility and remove all efficiency incentives from contracts or operations. Of course, higher-caliber, professional and technical managers are essential to cope with planning, evaluation, and organizational problems at all agency levels. But entirely new institutional forms and management approaches are also needed to streamline regulatory and public purchasing agencies and to free them from undue political influence on their decisions.

What can business do?

Now, what can business executives do—in their own self-interest—to help achieve the needed changes?

First, public markets and environmental controls must be approached as major strategic issues and not be relegated to back-bench decision makers. These issues pose some of the most critical opportunities and threats facing private enterprise in the next few decades. As such, they require companywide—if not industrywide—perspective and action. If companies do not respond to public demands effectively, the prerogatives of private enterprise can be swept away or drastically changed here as elsewhere. The threat is real. But so are the opportunities. As Henry Ford II said:

> "The successful companies of the last third of the twentieth century will be the ones that look at changes in their environment as opportunities to get a jump on the competition. The successful companies will be those that anticipate what their customers, their dealers, their employees and their many other publics will want in the future, instead of giving them what they wanted in the past. . . . These are

> the companies that will earn the highest profits for their stockholders by discharging their responsibilities to the society."[8]

Second, today's public demands cannot be dismissed as fads. They result from fundamental changes in population concentrations and affluence that will continue into the future. As one set of public problems is "solved," these and other forces will create new demands, which in turn will create new industries.

These new industries—to the extent that they add to production—will create some negative consequences. But, since their central purpose is to improve environmental quality, their net impact on the environment should be positive. However, in any complex system involving energy, manpower, and resources, there are likely to be some unpredictable consequences which may themselves create new challenges.

Any sensible scheme to satisfy them will leave essentially all production—and most technological—choices in private hands. But public groups must set the performance specifications and aggregate the resources to express public demands. To be effective their activities need aggressive business participation and support. Too often business groups—because of traditional thinking—have resisted legislation that could be in their own as well as the public's interest. To illustrate:

- Oil companies put up a powerful defense against the gasoline taxes that became the Highway Trust Fund. Yet this fund opened incredible growth opportunities for the industry.

Third, the notion of "business responsibility" alone will not solve current social problems. To gain short-term profits, some companies will always cut corners, struggle against safety or pollution regulations, and dogmatically resist public expenditures for health, education, or environmental quality. Some managements must lead the way—as many have in the past—to support social programs and to surpass all imposed environmental standards. Their leadership is absolutely essential to (a) create the favorable political environment so necessary for all business, (b) stimulate and restructure public markets to serve new public demands, and (c) develop standards that are economic and effective throughout industry.

Marketing and credibility

Developing public markets requires a consistent, long-term program. At the outset the company must identify where its own best opportunities lie. For consumer product companies this may merely involve promoting their product and its safety or environmental benefits. Public utilities may sell both their direct services *and* cleaner air or a less cluttered skyline. Other companies may need careful input/output or other analyses to see how larger public markets could benefit their particular operations, so that each can then select the few significant public opportunities it can most sensibly influence.

The next step may be to stimulate a deeper public awareness of what could be done. Depending on the status of public and political perceptions, fairly low levels of advertising and public relations may be adequate at this stage. The power of such efforts in the public sector seems generally underestimated.

The average person now spends more time in contact with TV and other media than in any other waking activity except his job. And these media are prime creators of personal values. If even a small percentage of media messages emphasize public needs, people could be vastly influenced. No single company has to dilute its product message appreciably, provided that others in the industry are working in the same direction. Interestingly, last year's enormous dissemination of environmental concern was probably achieved more by sponsored TV programs—new and otherwise—than by any other single force. The same power can be used to stimulate other public demands.

Once these demands begin to crystallize, more direct political action is possible. Responsible politicians have more latitude for action. And, if a company or industry has built up its public credibility and has a thoroughly thought-out position on key features of needed legislation, it can effectively lobby or participate in decisions covering public markets or regulation.

Such a program would have eased the problems of the automobile industry. Despite the substantial technical work the industry had done on environmental questions, the companies did not adjust automobile designs to mitigate growing public disenchantment with air pollution and accident costs. As political pressures built up for regulation, managements became increasingly defensive and emphasized the difficulty or impossibility of improved performance. Their intransigence gave their opponents added opportunities for attack. Public impatience increased. The industry lost credibility. And political activists forced more stringent regulations than would have been necessary.

Setting standards

In the environmental sphere, development of effective standards are the keys to progress. What specific approaches should industry support in its—and the public's—interest?

1. *Nationwide standards uniformly enforced are essential.* Otherwise, some local groups may lower standards or not have the political will or power to enforce them. Such situations create competitive inequities that reward those who act most irresponsibly. National standards also help build aggregate demand for depollution devices and systems, enabling some suppliers to achieve economies of scale, lower depollution costs, and create the jobs, tax revenues, and growth that could help pay for environmental improvement.

2. *Standards should be set well in advance.* Except in emergency cases like severe mercury contamination, standards should normally be announced at least three to five years before their effective date, and broad guidelines should be projected for a decade ahead. Only then can company and town managers minimize total costs by efficient planning of utility and plant locations, process changes, product designs, fund raising, and capital commitments.

3. *Performance specifications should be used whenever possible.* Material, practice, or product specifications freeze design and innovation. But functional or performance specifications can express the results desired. Managers can then choose the lowest-cost method for achieving these results, given the particular resources and processes available. Performance standards also encourage the research, innovation, and competition that can minimize total safety and depollution costs for society.

4. *Federal fiscal policies should be pointed toward the maintenance of total economic growth during the changeover period to help absorb displacements and short-term profit drains.* Such measures combined with carefully phased introduction of regulations could allow many industries' overall growth rates to more than offset substitution losses from minor differences in depollution costs among functionally competitive industries.

5. *Healthy regulatory agencies are essential for equity and progress in environmental control.* But they must be kept to minimum sizes, be exceedingly well-staffed, and be open to public scrutiny and policy review. Each major environmental agency should have the support of a competent technical laboratory system.

Legislation establishing regulatory agencies should define the physical goals to be accomplished along with fixed dates for achievement. And performance against these targets should be monitored, at least annually, through public reports. The entire mission of each agency should be reviewed and explicitly revised every five years to recognize the fact that environmental needs will constantly change.

Conclusions

Needed practices and institutional changes will only come about if an influential segment of industry acts vigorously and consistently in its long-term self-interest. The essential actions must come from the very top of the organization. If taken in time, such actions can be effective.

Top executives may have to make some critical changes in marketing attitudes and management controls to give public-market programs needed momentum. New-product efforts toward environmental improvement may need special long-term recognition and support at the corporate level—such as Carborundum and other companies have already begun to give them. And current profit and return-on-investment standards in operating divisions may need adjusting to allow the long-term investments in research, marketing, public relations, lobbying, and public action programs that help build their public markets. Further action may be needed to insure that middle managers do not cut regulatory corners to increase short-term profits. Companies seeking to build public markets will have to accept—and even encourage—environmental control over their own operations.

The public will not clean up dumps and sewage spills unless industries control their effluents. And both water and air depollution campaigns are integrally intertwined with other demands for better overall health care and recreational opportunities. These cannot be separated from transportation, open space, and housing demands, which in turn relate to traffic control, urban development, and other public-service commitments, including education. In short, these huge markets interlock and grow together—and whether they grow to become opportunities or threats depends on how industry responds to them.

Every new public demand for environmental improvement represents an unexploited primary market. Companies must take positive action to convert these demands into viable opportunities. Properly developed, such markets can be financed from the economic growth they permit; they need not create massive social overheads, as so many people assume. But improperly developed, they can become tax sinks, regulatory nightmares, and bureaucratic potholes that sap the resources of our whole society. The choice is largely up to business leadership.

Notes for Paper 8

[1] See Theodore Swanson, "Europe Cleans House," *The Lamp*, Spring 1971, p. 38.

[2] *The Human Environment and Business* (New York, Weybright and Talley Inc., 1970), p. 63.

II.9 Incrementalism and environmentalism

Charles Lindblom *

In simplest form, the answer to the question "How are we to translate broad goals and comprehensive plans into action programs" is "Don't!" That does not mean that I oppose action programs. I support action programs. I also advocate planning. What I bridle at is stress on the breadth of goal and the comprehensiveness of plan.

The axiom that plans ought to be comprehensive and goals ought to be broad which is an axiom many of us take for granted, indicates that the study of planning and policy making and the practice of them are still in their infancy. On any kind of sober view of how to go about planning and goal setting, two attributes of action programs to beware of are breadth and comprehensiveness.

As I see the world of policy-making or the study of decision-making, there are fundamentally — speaking very broadly — two hypothetical alternative approaches to making intelligent decisions on complex matters. The first is to aspire with never-ending frustration to be comprehensive, broad and complete, to wrap up together all aspects of a program, to master it intellectually, to comprehend it in all aspects. To succeed in this is, however, in actual fact impossible. For any complex problem, it cannot be done. I am not on that point idiosyncratic. If you examine some of the rich contributions to the literature on policy-making and decision-making, particularly in the last ten or fifteen years, you will see that an increasing number of people recognize that these are really foolish aspirations, since one cannot be comprehensive, one cannot be complete, one cannot be completely broad (only erratically broad) for complex problems.

Selective decision-making

The alternative and feasible method, therefore, of getting into action programs, or thinking intelligently, or acting intelligently, on complex problems—the problems we face in the public policy and environmental fields—is to be discriminating, selective, corner cutting, tricky, cunning, strategic, and tactical. The second broad alternative is to recognize that we must reach a decision before we have intellectually mastered the problem and that we will somehow have to make a decision and begin to act long before all the facts are in. We shall have to come to some kind of conclusion long before we can achieve any kind of comprehensive or broad mastery of a plan.

What a skillful planner ought to do consequently is to ask, "What are the defensible, skillful, or tactically useful ways to cut corners? What are the defensible ways, to put it crudely, to botch a job, since all policy-making is going to be botched to some significant degree?" The decision maker must face up to the fact that he is going to make mistakes. He must decide, therefore, how to pick and choose among elements of his problem in order to devise in some skillful, imaginative way a realizable solution. His will be a method full of error, but errors that are somehow easier to live with or more correctable than others or errors that give him more feedback information for future decision steps than do others. Skill in policy-making, talent, inventiveness, or genius is not in pursuing the will-o'the-wisp of breadth and comprehensiveness, but in developing a kind of low cunning or brilliance in improvisation, in tactics for corner cutting, in learning a high degree of selectivity and discrimination, in making

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*Presented by Charles Lindblom, Professor, Yale University, at the National Conference on Managing the Environment.

up highly focused rather than broad attacks on problems. Good action programs should lay out sequences of attacks, so that sustained attack may be sustained in the face of repeated inevitable error and in fact draw information through feedback from that error to make the sustained attack increasingly well-focused and precise.

Planning as scholarly group therapy

Why planners resist the common sense choice between the impossible and the possible—why they often persist in broad goals and comprehensive plans—needs explaining. Several considerations throw light on why we are wedded to the old-fashioned axiom that the way to be intelligent about policy is to be broad and comprehensive, instead of selective and strategic.

One is that this old axiom is conventional scholarly wisdom. We draw our canons of good policy making procedures from the scientific method. In a conventional understanding of the scientific method, man attempts to grasp, to master, to understand, to comprehend. Consequently, all the prestige of science bolsters the conventional notion that these are virtues for policy makers too, regardless of the complexity of policy problems when compared to the relatively constrained scientific problems that most scientists deal with in their own academic work.

Second, modest and realistic tactical or strategic selective approach to policy is painstaking hard work and not very exciting. It requires that social change be smuggled into the social system, rather than introduced with flags flying. Many of us recoil from meticulous, persistent repair work and lunge off in the direction of glamorous comprehensive plans. We may do so for the same reason that many people enjoy buying something new as therapy. Comprehensive planning is one of the great therapies of hard-pressed policy-makers. It is a way of getting into something fresh and new. Among its other attractions are the minor therapies of white paper and unsoiled notes instead of messy old files and the dismal record of past failures.

A third reason for a bias toward the broad and comprehensive is that most of us believe that because we became involved in our environmental difficulties piecemeal, we shall have to get out comprehensively. If piecemeal gradualism was the way that we blundered into our environmental problems, then clearly we shall have to devise some other method to get out.

Clearly the argument contains a fallacy. We did fall into our environmental problems through piecemeal gradualism. That still leaves open the possibility that the same route is the only route out of the problems. There are no logical defenses for "in one door, out another."

Everything is connected . . . but to what?

Finally, many of us resist selective, highly focused programs because we now understand that the environment is all interconnected. It is a system. We are deeply impressed as we have never been before with the interrelation of parts. Believing, then, that everything is interconnected, we fall into the logical fallacy of believing the only way to improve those interconnections is to deal with them all at once.

Clearly, everything is connected. But because everything *is* connected, it is beyond our capacity to manipulate variables comprehensively. Because everything is interconnected, the whole of the environmental problem is beyond our capacity to control in one unified policy. We have to find critical points of intervention—tactically defensible, or strategically defensible points of intervention.

I have presented two models—the traditional, conventionally scientific method of policy-making, and the other, the much more highly selective, incremental, tacitcal focused method of policy-making. There is no doubt about which one we can more skillfully exploit.

II.10 Decision-making for environmental quality

Peter W. House *

Rather than assume the initiative, our society tends to react passively to environmental problems. Pollution is treated as a problem to be corrected not avoided. The instinct is for each Federal, State or local agency to treat individual environmental problems as separate entities and to concentrate on short-range crises rather than long-range trends. This approach is inefficient, not only because of its tendency to duplicate efforts, but also because it ignores the fact that pollution abatement problems are long term, intertwined and mutually dependent. One problem cannot be attacked without having a short- or long-range impact on several others.

This paper will consider the two related concepts of comprehensive planning and long-range planning as they relate to environmental efforts. Comprehensive decision-making is concerned not only with the local impact of decisions but also with the effects of a policy decision throughout the entire system. Long-range decision-making takes into account the full time-frame necessary for the total significant impact of a decision to be felt.

Competition vs. planning

These two concepts are not uniformly implemented by all levels of decision-makers. For example, individual governmental departments or private firms tend to be primarily interested in their own survival or growth. The competition at these levels is, by its very nature, not conducive to cooperative, comprehensive planning. The decision maker at a higher policy level does, however, have an interest in cooperation since his main strategy is to maximize the quality of life of his constituency. His interest is in getting agencies to work together to improve (at least marginally) the conditions of life in the area. While social strategies ought to be judged in terms of long-run quality-of-life measurements, such measurements and goal statements are not universally agreed upon, nor are the sacrifices that the goals may require acceptable to all.

Since most of the severe pollution problems are associated with urban areas, efforts at comprehensive planning and at avoiding detrimental side effects from environmental correction actions are complicated by the complex and dynamic nature of urban existence. Consequently, this paper will begin by discussing the effectiveness of existing pollutant - oriented decision - making as contrasted with a more system-wide or "holistic" approach. The second section provides a brief overview of the historical development of both urban areas and urban theory, presenting those areas as dynamic systems and illustrating the impact which prevailing urban theory has upon the environmental decision-making process. Urban environmental planning is the focus of the third section, reflecting the earlier discussion of decision making and the urban theory. Finally, the problem of planning in a rapidly changing environment is discussed from the decision-maker's viewpoint.

Framework for decision-making: the comprehensive approach

Decision-making in environmental matters must be done with an overview of the system-wide application of each decision—a holistic approach. This is made obvious by two factors: the nature of the pollution process and the

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*Peter W. House, Ph. D., is Director of the Environmental Studies Division, U.S. Environmental Protection Agency. This paper was presented at the Sixth Hawaii International Conference on System Sciences (HICSS-6) January 9-11, 1973.

cumulative impact that urbanization, population growth and economic development have on pollution levels.

The pollution/natural cleansing process in the environment reaches a critical breakdown point (in lakes the process is called eutrification) when the natural system is overloaded with more waste matter than can be absorbed and recycled. When this happens each individual pollutant may augment the damage caused by other pollutants and thus compound the damage to the system as a whole. To be most effective, therefore, the enivronmental decision-making must concern itself with the sources and interactions of all forms of pollution rather than simply treating each pollutant as a separate problem.

The second factor encouraging a more comprehensive system-wide approach to environmental decision-making involves the dynamic and cumulative effect of population levels, economic growth and urbanization on pollution trends. A growth in any of these three factors can result in an even larger proportional growth in pollution. Consequently, attempts to curb pollution should recognize the complex, dynamic interactions between economic and demographic factors that add to environmental problems.[3] Prior to discussing the urban situation, however, it is necessary to investigate the decision-making apparatus itself.

Two approaches to decision-making

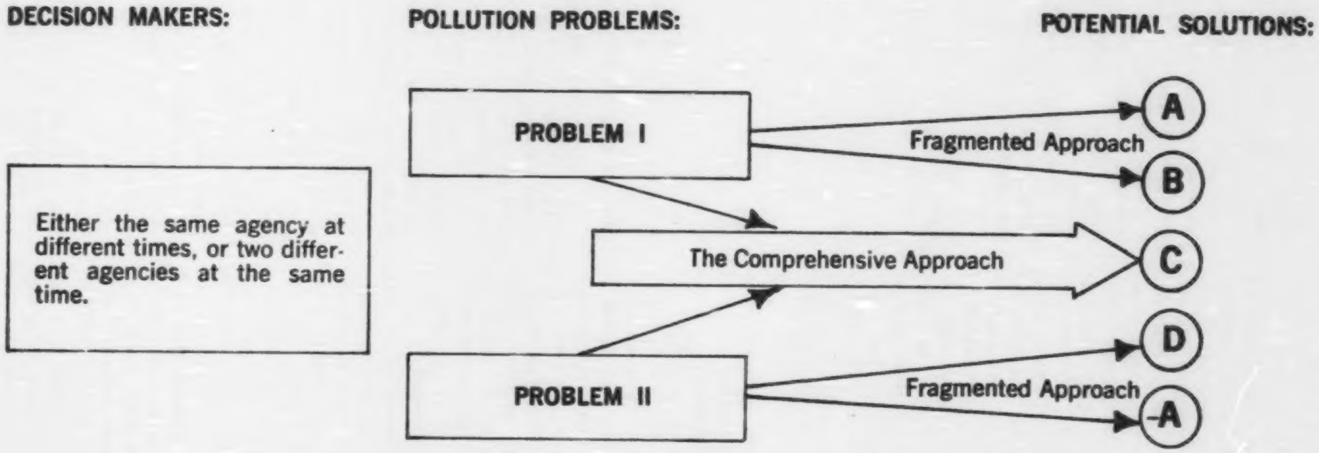
The decision-making activities of the Federal, regional and local environmental commissions are often notable for their reactive tenor. They "react" to specific pollution crises or polluting agents with action decisions intended to alleviate the crisis while minimizing their disruptive impact on existing institutions. On the other hand, the original mandate given the Environmental Protection Agency and the Council on Environmental Quality was to look at the environment from a comprehensive or holistic point of view. The National Environmental Policy Act of 1969 authorizes and directs that all agencies of the Federal Government shall utilize an interdisciplinary approach to assess every major program, project or piece of legislation which might have a significant environmental impact.

The differences between situation-oriented decision making and systems-oriented decision making are illustrated in Figure 1. This illustration demonstrates both the short- and the long-range effects of these two types of decision making. In the short run (i.e., situation 1 and 2 arrive simultaneously), situation-oriented planning treats each problem (in this case a polluting agent) as a separate entity. As such, a duplication of efforts may result, or two programs might be working against each other. A comprehensive approach could avoid such wasted effort by treating each situation as part of a larger structure, defining the relationship between situations, and finding common solutions to multiple problems. In the long run, the holistic approach might avoid the possibility of the solution to one problem creating or complicating other problems.

In general, this decision process includes: (1) perception of the environment, (2) definition of the purpose of the changes one wishes to effect in the environment, and (3) design of the acts whereby the environment will be altered. Perception of a problem or a situation in need of an improvement is the first step and is a function of the individual's, group's, or society's prevailing value system. It is only in terms of such a value system that judgments can be made as to the nature of the situation and the immediacy of the need for action.

If planning is viewed as simply a problem-solving device, then the emphasis will be on changing the environment while leaving the value system untouched. If, on the other hand, planning is viewed as a continuous long-range organization of progress throughout the environment, it is necessary to consider changes in the value system as well as the environment to keep the two in harmony.

FIGURE I.—COMPREHENSIVE VS. FRAGMENTED DECISION-MAKING


DECISION MAKERS:
POLLUTION PROBLEMS:
POTENTIAL SOLUTIONS:
Either the same agency at different times, or two different agencies at the same time.
PROBLEM I
PROBLEM II
Fragmented Approach
The Comprehensive Approach
Fragmented Approach
A
B
C
D
-A

A comprehensive approach to decision-making looks to finding the solution which will have the least negative (or most positive) affects on the entire system. Solutions which work against other solution (A,–A) are identified and avoided.

Long-range planning

Given the extreme complexity of those factors which affect environmental quality and the dynamic changes constantly being introduced into the system by social and technological developments, accurate long-range planning is becoming an increasingly difficult task. But, at the same time, it is becoming even more necessary. A century or more in the past when changes were less radical and occurred more slowly, a simple extrapolation based on then-prevailing patterns could be made by planners—with a high degree of confidence. Today, however, major social and technological changes occur with such rapidity that long-range plans are made only with a high degree of uncertainty regarding their relevance in terms of distant future conditions.[3]

This uncertainty is being lesssened to some extent by the increasing power of our society to mold the future. Governmental decision-makers are becoming increasingly conscious of this power to control the future. In some areas environmental concerns (for example, the shape of transportation, water quality and energy production and consumption) are being committed decades into the future. Such extensive, long-range planning efforts to mold the future require a continuous, consistent and cooperative pursuit on the part of the decision makers involved.

Such consistent pursuit of a long-range goal may give rise to serious conflicts of future interests with the interests that motivate the original plan. In periods of rapid change, contemporary planners are locking future citizens into forms which are being dictated by present, not future, interests. This "imperialism" on the part of contemporary planners requires that they make every effort to consider future evolving interests as they create their plans, and to somehow make the plan sensitive to evolving interest patterns.

As if such considerations were not sufficient to overwhelm most long-range planning, it should be remembered that all of this interest-weighing is taking place within the context of the political system. This system imposes severe constraints on the planning process. In cases where the future condition of a system is poorly defined, the tendency of the government is to adopt a "wait-and-see" attitude while the situation ripens. Thus, a problem may be allowed to develop into a crisis before any remedial action is taken, and the long-range planner is wasting his breath if he cannot support his warnings with proof that the problem in question will definitely damage the interests of a significant socio-political grouping unless acted upon immediately.

Another problem imposed on the long-range planning process by our political system is the tendency of some elected officials to over-promise and under-deliver. This proclivity has jaded the public and made them skeptical of any long-term analysis coming from governmental sources. As a result, especially in the environmental area, people are reluctant to make present sacrifices for future benefits.

The urban phenomenon

As mentioned earlier, urban areas, with their high concentration of people, transportation facilities and industry, have been a major focus of pollution control efforts.

It is beneficial to the urban environmental manager to have an understanding of the popular theories of urban growth and how these theories are evolving—not only to improve his understanding of the development of urban areas, but also to develop an appreciation of how the planner conceives of urban growth. For these reasons, the following section will consider the development of cities and of urban theory.

Explanations of why cities are located in particular places have generally divided into two theories: the central place theory and the "break-in-transportation" theory. The central place theory views cities as regional service centers which provide goods and services for the agricultural hinterland.

The specific locus of these cities is dependent on the topography of the region approaching a central position as the terrain becomes more uniform.

The "break-in-transportation" theory is quite similar, relating the location of cities to points in the transportation system which require a change in the mode of travel, e.g., land to water, road to rail, etc. These places, referred to as "break-of-bulk locations" often grew where it was necessary to do the phyical work of loading and unloading cargo. They became not merely a meeting of transportation modes but also served as centers for the processing of various goods.[3] Numerous other reasons have been given for urban locations, including political considerations, religious factors, and so forth.

Moving from analyses of urban location to urban development, a comprehensive analysis of city growth stages is presented by Wilbur Thompson's four stages of urban growth. These stages are: (1) the town is largely built around a single industry or firm; (2) the "company town," if the industry or plant is successful, grows to include other industries which either handle some phase of the manufacturing process of the original firm or require the output of the parent firm; (3) the local economy begins to expand and to supply its own local needs through other industries; (4) the city becomes the controlling node of a group of cities and now exports not only the goods supplied by the original firm and its later symbiants, but also exports services to the surrounding cities which are still too small to support their own.[4]

It is important to note that each of these stages of industrial-commercial growth has shaped the character and form of urban areas. Decisions made by present-day decision-makers should take into consideration that their locale is only at a point in its development and should not regard the present as a constant.

The urban pattern and its concurrent theoretical descriptions can be viewed as having progressed through four states: (1) the clear-cut rural-urban dichotomy; (2) the development of cities with identified hinterlands, where both areas are still clearly distinguishable; (3) the development of the metropolitan area where the city fades gradually into the rural countryside; and (4) the growth of large numbers of multiple nuclei resulting in no clear city or rural distinction in the metropolitan area. The growth and development of urban land forms thus follows an observable pattern.[5] This growth pattern determines the distribution of land uses within the city itself, and hence the impact, both localized and regional, of the city upon its natural environment. (See Figure 2)[6]

Urban problems are moving targets

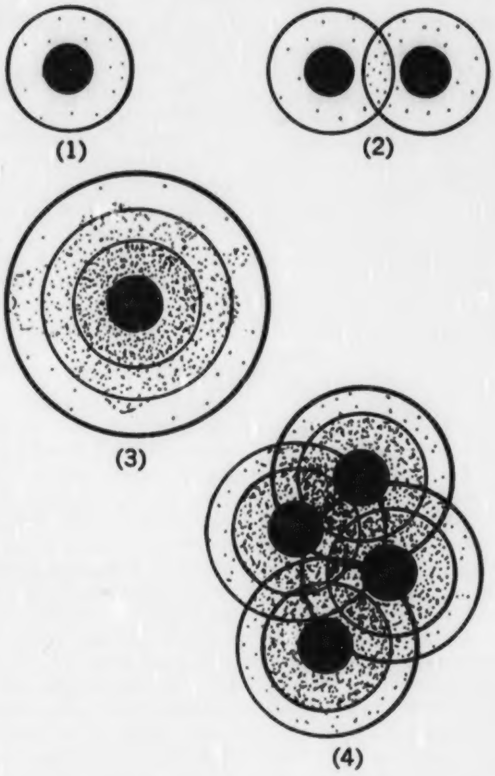
Ignoring urban dynamics has led to the concentration of pollution-control efforts on the immediate symptoms of the problem. Many such efforts are now, or eventually will prove to be, ineffective in the long run. Ignoring the complexity of urban forces has resulted in pollution-alleviation efforts in one sector which have either aggravated problems in another sector, or have created new and undesirable forces.

For example, the attack on air pollution has been conducted by a variety of agencies each with responsibility over some aspect of air quality control. The lack of a holistic approach to urban air quality efforts can have a far-reaching impact on the rest of the urban environment. For instance, added mass transit facilities, if electrically powered, place increased strains on power generation stations during peak-use hours. This can cause power companies to employ older generators or less clean fuels thus, again, adding to air pollution. The specific examples are almost endless.[7]

A condition similar to the air quality example exists in the area of urban solid waste treatment. The solid wastes which are of greatest concern to urban areas are municipal refuse, industrial wastes, and the solid residue remaining after volume reduction operations on liquid and solid wastes.

Of an estimated national annual solid waste total of 3.6 billion tons, almost

FIGURE 2.



200 million tons are household waste or 4.3 pounds per person, per day. The collection and disposal of municipal and industrial wastes cost approximately $4.5 billion per year. As a result of our improving standard of living and the trend toward disposal products, it is estimated that each of us will be discarding eight pounds of solid waste a day by 1980.[8]

Here again is an example of the interrelatedness of urban environmental problems. Refuse collection is far more difficult in the central city because of traffic problem which contributes substantially to air pollution impairs the freedom of refuse vehicles to move effectively along their routes. Finally incinerators currently in use represent another "problem" to the central city principally in their inadequacies and in their contribution to air pollution.

As a result of the uncoordinated effort, pure improvement is rare. Instead, improvement in one area often causes deterioration in another. More research is needed to coordinate efforts and obtain the most desirable long-term results with the most efficient methodology. Less work, in a relative sense, should be done to "band-aid" the problem.

Long-range planning in a changing world

Planning is a process of projection under uncertainty. The projections are based upon present data and knowledge with continued monitoring and replanning as necessitated by a changing environment. The planning process should be dynamic in application.

The purpose of the environmentally conscious planner is to develop a methodology that avoids conditions which would significantly damage the "quality of life" as perceived by this and future generations.

There are three characteristics of effective planning: First, plans are directed toward creating new norms and values which will be more conducive to environmental harmony. Second, goals are set with a view toward their feasibility given the available resources. Third, administrative capabilities are created to implement desired strategies in terms of the priorities, schedules, etc.

In dynamic planning, periodic reassessments are carried out to assure that planned activities remain consistent with the evolving facts (the data base). Through these reassessments, the planning process evolves in a self-regulatory fashion. The next stage in the process sounds as though it were formulated with a "buzzword generator." Nonetheles, an improved environmental planning technique would take a holistic approach involving a multimedia, comprehensive, and long-term analysis of the situation. The tools and methods that exist, however, permit no more than a beginning for such a task. (See Figure 3)

Figure 3 is adapted from the International City Management Associations' book entitled, *Principles and Practice of Urban Planning*. The diagram suggests an approach that can be used by the state or local planners to prepare a standard comprehensive plan, which considers the environmental impacts of the plan. The comprehensive plan, if well-conceived and supported by the populace, is a powerful instrument of policy guidance and control. Under such conditions it sets boundaries for the local citizenry and developers as the area moves through time. Concomitantly, it sets goals for the policy maker to maintain and foster, if he is to remain popularly elected. Research is currently underway to devise a technique for preparing an environmental impact statement on a total comprehensive plan rather than on each individual project. If such a technique can be implemented, the synergistic, as well as the direct, effects of decisions can be more readily taken into consideration. Several efforts within the EPA and elsewhere have begun research in the areas of designing and perfecting such analytical techniques.

Barriers to environmental planning

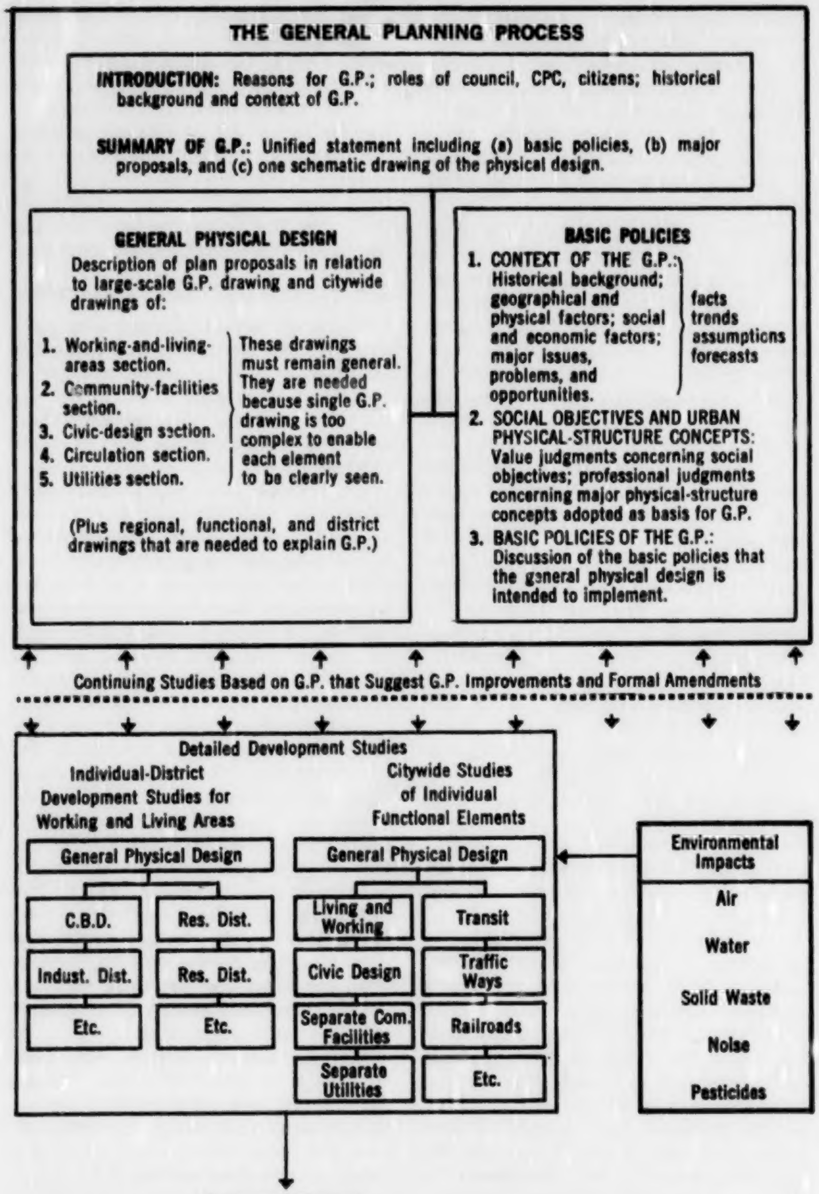
There are several reasons why planning for the environment is generally not carried out on either a comprehensive or long-range basis. In no case are the following general rules suggested as exhaustive but they do serve to illustrate the range of possibilities.

(A) Those who are professionally concerned with environmental issues, as well as those whose interest grows out of avocation, seem automatically to assume that everyone percieves the environment as they do. Pollution prevention, however, is not without cost, and those who must pay the cost are often less than enthusiastic about the crusade. The industry or farmer which faces large capital costs to improve environmental practices is seldom an environmentalist. The list of such disenchanteds is likely to be quite long and makes up a considerable backwash for the environmental movement. This potential opposition helps to define the constituency of a policy maker. Not only does it make a difference who brings ideas to the decision-maker and how ideas are transmitted to his constituency (and the feedback to him) but the opponents' strength and position will also help shape policy.

(B) As almost everyone who deals with large numbers of people knows, the training one receives in a professional discipline colors one's whole outlook and helps determine the way one carries out analysis and develops policy suggestions. The following typology is suggestive of this phenomenon: •

(C) The frame-of-reference of the decision-maker is a further extension of

FIGURE 3.*



THE GENERAL PLANNING PROCESS

INTRODUCTION: Reasons for G.P.; roles of council, CPC, citizens; historical background and context of G.P.

SUMMARY OF G.P.: Unified statement including (a) basic policies, (b) major proposals, and (c) one schematic drawing of the physical design.

GENERAL PHYSICAL DESIGN

Description of plan proposals in relation to large-scale G.P. drawing and citywide drawings of:

1. Working-and-living-areas section.
2. Community-facilities section.
3. Civic-design section.
4. Circulation section.
5. Utilities section.

These drawings must remain general. They are needed because single G.P. drawing is too complex to enable each element to be clearly seen.

(Plus regional, functional, and district drawings that are needed to explain G.P.)

BASIC POLICIES

1. CONTEXT OF THE G.P.: Historical background; geographical and physical factors; social and economic factors; major issues, problems, and opportunities. — facts, trends, assumptions, forecasts
2. SOCIAL OBJECTIVES AND URBAN PHYSICAL-STRUCTURE CONCEPTS: Value judgments concerning social objectives; professional judgments concerning major physical-structure concepts adopted as basis for G.P.
3. BASIC POLICIES OF THE G.P.: Discussion of the basic policies that the general physical design is intended to implement.

Continuing Studies Based on G.P. that Suggest G.P. Improvements and Formal Amendments

Detailed Development Studies
Individual-District Development Studies for Working and Living Areas
Citywide Studies of Individual Functional Elements
General Physical Design
C.B.D.
Res. Dist.
Indust. Dist.
Res. Dist.
Etc.
Etc.
General Physical Design
Living and Working
Transit
Civic Design
Traffic Ways
Separate Com. Facilities
Railroads
Separate Utilities
Etc.
Environmental Impacts
Air
Water
Solid Waste
Noise
Pesticides
(see next Figure)

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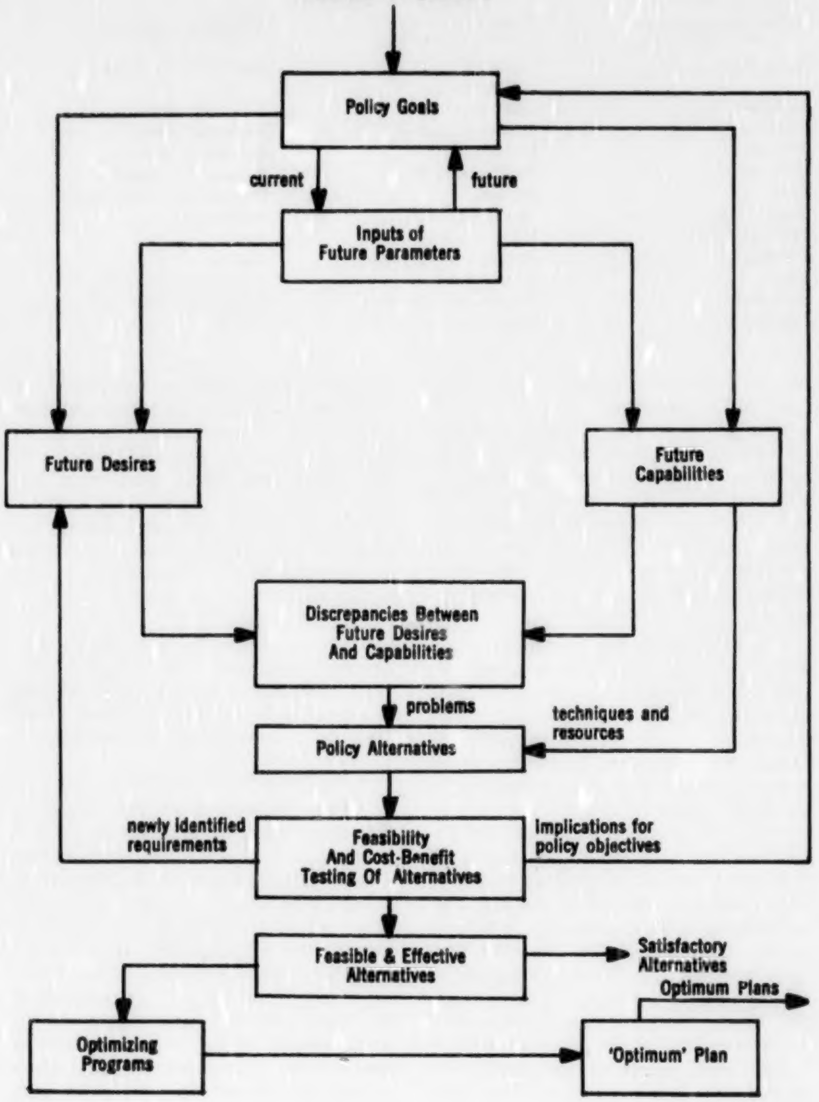
*Adopted from Figure 13–1, page 359 of Goldman, William I., ed. *Principles and Practice of Urban Planning*, by the International City Managers' Association, Washington, D.C. 1968.

FIGURE 3. (CONT.)



Policy Goals
current
future
Inputs of Future Parameters
Future Desires
Future Capabilities
Discrepancies Between Future Desires And Capabilities
problems
techniques and resources
Policy Alternatives
newly identified requirements
Feasibility And Cost-Benefit Testing Of Alternatives
implications for policy objectives
Feasible & Effective Alternatives
Satisfactory Alternatives
Optimum Plans
Optimizing Programs
'Optimum' Plan

Institution, social role or cultural subsystem	Decision method	Meaning—goal
Economics	Calculation of costs-benefits	Maximize benefits
Religion	Contemplation	Spiritual truth
Philosophy	Logic, reason	Rational truth
Science	Experiment	Empirical truth
Ecology	Field research	Fitness, adaptation
Arts	Design	Expressive form, beauty
Technology	Invention, test	Efficiency
Jurisprudence	Hear evidence	Justice
Politics	Bargain, compromise	Equity
Law	Social need	Rights, duties, order
Personal	Integrative, sacrifice	Solidarity, love
Medicine	Diagnosis	Health

his professional prejudice. Not only does the information for policy alternatives get prepared from specific policy viewpoints, but the decision-maker himself also has a set of specialty blinders. This feature of the power chain influences the type of people the decision-maker is apt to have as part of his advisory staff and defines the filter through which the information is processed.

(D) The discipline of the decision-maker can be tempered if he is the type of leader who is willing and able to assimilate new information. This feature of the leader's personality requires the endurance and stamina to carry forward the new information to an action stage.

(E) The above features of the decision-maker all point to the very real nature of the day-to-day world of policy making. Activity at the top is always fierce and in constant motion. It is the world of *NOW*, and the time span beyond his purview is relegated to taking care of itself. All of the reward and threat of our system is structured to support this mode of operation.[10]

(F) The concept of time itself constrains the decision-maker. The most receptive time for information is at a similar period of crisis. All problems at these periods are immediate and require generous mixtures of insight and action. As time goes on, more and more of the organization is clothed in laws and regulations. These were usually formulated during the period of crisis. Both of these time-oriented features tend to result in policy proclamations which are oriented toward the immediate: the people who responded best to the crises surrounding the decision-maker are normally either titularly or figuratively elevated to more powerful positions. Since their reward is the result of an expertise in short-run policy analysis, they usually continue this tendency. The agency, with its regulations and rules, becomes similarly oriented. In short, there is little in present day reality to facilitate either long-run or comprehensive analysis.

The environmental analyst

The contention of this paper is that there must be comprehensive and long-run planning of the environment if the decision-maker is to promulgate policy which will actually have the effect of both cleaning up and preserving the environment. It is hoped that the cursory excursion through urban theory (and history) has convinced the reader that it is a dynamic and, in some senses, living system which is apt to respond in a perverse and often unexpected fashion when fed piecemeal, stopgap measures. Finally, even though this argument appears convincing and methodologies exist for accomplishing environmental comprehensive planning, it is seldom done. The reasons are legion but they can be summarized most logically under the heading of poor, inadequate, and misinformed advisors to the policy-maker.

This feature is not a result of capriciousness on the part of the advisors, but of the fact that these people are also constrained by their training and by the need to satisfy their professional community.[8] There does not appear to be any group which would be dedicated to supporting the policy-maker in environmental issues, as a full-time vocation. To further illustrate this void let us visualize the following typology:

Basic research	Transfer agent	Transfer process	Output
Physical and natural sciences	Engineer	Market place	Product
Social sciences	Planning Operations research Popularizing	Political arena	Policy

support. Unfortunately, numbers of the people who would like to fulfill this function find it too risky, in a professional sense, to become tainted with "merely" implementing somebody else's research. Those who bridged the chasm between basic social research and the political arena have been called popularizers, especially by the basic scientist who does not see the translation of his jargon to more generally readable form as being useful, in the sense of advancing the state-of-the-art.

To effectively support the policy-maker on environmental issues, we will have to create and support a new scientific layer in the professional community of the social sciences. In the natural-physical sciences the basic research that is carried out is generally of a nature which is unsatisfactory for implementation. Generally the research is of a more esoteric quality and the usefulness of the research to groups outside the particular discipline is seldom a criterion in judging its quality.

In order to facilitate the transfer of a select number of these research findings, the portions of society concerned with production have been willing to support a group called "engineers." The engineers are accepted by not only the producers but by the basic researchers. The situation results in the engineers developing their own professional ethic. Because this group of professionals is supported by the producers, the objectives of the engineers reflect the needs of this group. The engineer prides himself on being a problem solver; he seldom looks at a problem from the perspective of how the objective can be accomplished.

The policy-maker in the government arena really needs this same sort of

Another, more readily definable group has attempted to fill the gap. These are the planners. Their profession has grown up as complimentary in the sense of the engineer. The planner has tended to define his areas of interest in line with political and administrative jurisdictions. Unfortunately, for the policy community, these people are not usually available for day-to-day support, nor do they usually possess the skills necessary to handle the analytical chores required by comprehensive, long-range policy-making. This gap is being rapidly filled by still another contingency—the operations researcher.

Search for a policy scientist

The purpose of this sorté through the search for a legitimized policy scientist, or environmental analyst, is to suggest that it is only when such a profession is created that the decision maker will have the impetus to take the future into consideration. The environmental analyst will have this long-range viewpoint because of the training provided in his discipline, and his logic will be reinforced by his peers. The decision maker will have the confidence (rightly or otherwise) to meld these factors into his policies, or his advisors will do it for him and attest to the soundness of the practice. It is not, in short, logical to assume that the decision maker—who is a successful political animal—will change his habit pattern to a less certain strategy. Therefore, the change will have to come from his advisors, who concomitantly will have to receive support and encouragement from their own peer groups.

In conclusion, comprehensive long-range planning is both vital and inevitable. Vital because of the opportunities missed and the dangers risked by any other approach to environmental planning. Inevitable because the complex dynamics of modern sociopolitical and economic structures cannot be handled in any other way. Such an approach to planning will, however, breed a whole new set of problems, some of which have been mentioned above. Anticipating these problems and encouraging the trend toward long-range comprehensive planning will improve both the efficiency of policy actions in the short run and the possibilities of obtaining the desired future in the long run.

Notes for Paper 10

[1] "Forecasting," Environmental Quality, The Third Annual Report of the Council on Environmental Quality, August '72, pp. 72-73.

[2] See also Leonard J. Duhl, "Planning and Predicting," in Daniel Bell (editor), Toward the Year 2000: Work in Progress, (American Academy of Arts and Sciences, 1968), pp. 147-156.

[3] Chas. Horton Cooley, Sociological Theory and Research (Clifton, N.J., Kelley, 1930), pp. 17-118.

[4] Wilbur R. Thompson, *A Preface to Urban Economics*, published for Resources for the Future, Inc., by the Johns Hopkins Press, Baltimore, 1969, pp. 15-16.

[5] See, for example: Ernest W. Burgess, "Urban Areas," in T. V. Smith and Leonard D. White (eds.), *Chicago: An Experiment in Social Science Research* (Chicago: Univ. of Chicago Press, 1929), pp. 114-123; and Homer Hoyt, *The Structure and Growth of Residential Neighborhoods in American Cities* (Wash., D.C., Federal Housing Authority), pp. 112-122.

[7] "Solid Waste," *Improving the Inner-City Environment*, A Report to the Administrator of the Environmental Protection Agency, by the Task Force on Environmental Problems of the Inner-City, Jan. 31, 1971, p. 2-2.

[7] See also Harvey S. Perloff, "A Framework for Dealing With the Urban Environment," introductory statement in Perloff (editor), *The Quality of the Urban Environment*, (Washington, D.C., Resources for the Future, Inc., 1969), p. 21.

[8] Typology from Farness, Stanford S. "Resources Planning versus Regional Planning," *Future Environments of North America*.

[10] It is interesting to note that consultants who have developed powerful decision making tools for the policy levels have noted great problems in transferring the tool. Because of day-to-day pressures of the job at the top, the only way to transfer or upgrade the decision team is to follow the business practice of keeping two machines in operation until the new machine is ready to take over. The problems of such staffing are obvious, but other solutions seem just as untractable.

[11] Perusal of college catalogues shows that, for those who majored in the areas of law, social science, business, public administration and liberal arts more than a decade ago, few had any training in analytical subjects and probably none in computer sciences. This means that a large portion of our policy leaders and their advisors are conversant with modern decision-making tools only to the extent that they have educated themselves. The subsequent fear of the new and unknown is a serious impediment to change.

III: Organizing for Environmental Management

INTRODUCTION

"It appears that the awareness level of the citizens throughout the United States is centering a growing concern for the environment on the various governing bodies and their staffs to effect meaningful programs. . . ." This citizen concern, as noted by Richard Gray, City Manager of Norman, Oklahoma, opening the discussion of "Local Government Experience," has been communicated clearly to public officials at all levels of government. The resulting rise of environmental awareness and the increase in environmental programs have been accompanied by changes in the organization for environmental management.

One of the fundamental tasks of managers is organizing available resources to address specific problems. Because organizing involves the distribution of an agency's resources—staff (size, expertise, and role), budget, and authority—it is one of the crucial determinants of program success. An "organizing" decision is made on every problem facing a manager, even when the decision is not to make an organizational change and to address problems through existing arrangements.

The manager's decision on "organizing" depends upon his perception of the problem. Environmental problems can be viewed narrowly or broadly. For example, exceeding the capacity of the sewage treatment plant and dumping untreated sewage into a river can be seen as either too small a plant or unbalanced (or too much) urban development. Most likely a manager would address these two problems quite differently.

Other factors that influence "organizing" decisions include: political pressures, financial status, federal or state requirements, existing staff capacilities, relation to other policies and programs, and the personal knowledge and skill of the manager.

In making organizational decisions, it is necessary to consider the dynamics of the organization that will exist after the decision is made. An organization can be described as a system of mutually dependent variables, including: the individual, formal arrangement of functions, informal arrangements of functions, behavior patterns resulting from role requirements of the organization and role perceptions by the individual, and the physical environment. All of these factors should be considered in planning organizational changes as well as for evaluating organizational effectiveness. The remainder of this chapter, however, will deal mainly with the formal arrangement of functions.

FEDERAL ENVIRONMENTAL ORGANIZATIONAL EFFORTS

An important move toward consolidating environmental responsibilities occurred in 1969 when the Council on Environmental Quality (CEQ) was established by statute (the National Environmental Policy Act) to provide top-level policy advice and coordination in the environmental area. The CEQ is the only major part of the Executive Office of the President devoted exclusively to a particular substantive policy area. The rationale for making this exception is the special nature of the environmental problem, affecting the entire fabric of the federal government.

The second major organizational change was the consolidation of all the major pollution control programs under the Environmental Protection Agency (EPA). The creation of EPA was recommended by the President's Advisory Council on Executive Organization. The Council's recommendation was accepted by President Nixon, who sent it to Congress as Reorganization Plan Number 3 of 1970. In his message to Congress, President Nixon criticized the existing piecemeal approach and stated that "our national government today is not structured to make a coordinated attack on the pollutants which debase the air we breathe, the water we drink, and the land that grows our food. . . ."

On December 2, 1970, EPA came into existence by Executive Order 1170. EPA inherited $1.4 billion in appropriations, twenty-one diverse grant programs, and 5,400 people in 157 locations. Placed in the agency were programs from five departments and independent agencies, including the Interior Department's Federal Water Quality Administration; the HEW Department's National Air Pollution Control Administration, Bureau of Solid Waste and Bureau of Water Hygiene; pesticide registration, research and regulation functions of Agriculture, Interior, and HEW Departments; and certain radiation functions of the Atomic Energy Commission, the Federal Radiation Council and HEW's Bureau of Radiological Health.

Major program omissions were: the authority retained by the Food and Drug Administration to confiscate pesticide-contaminated food; the HUD sewer construction program; and programs for community environmental health (mainly rat control and lead paint control) in HEW.

Details of the initial organization were worked out by a fifteen-member task force from a variety of federal agencies (not directly affected by the organization) under the auspices of the Office of Management and Budget. The two primary organizational goals which shaped the development of EPA were: functional organization and decentralization.

An interim organization was created featuring five topical "offices" for water, air, radiation, pesticides, and solid waste, each headed by a commissioner. On April 30, 1971, a major reorganization occurred; since then, all subsequent changes have been modifications of that structure. The basis for the organization is partly along "functional" lines—Planning and Management, Research and Development, Enforcement and General Counsel—and partly in "program" lines—Air and Water Programs, Categorical Programs (radiation, solid waste, pesticides, noise, etc.). EPA also gave priority to decentralizing its operations as much as possible to the ten regional offices. Regional administrators were given a broad charge by an internal EPA Order (No. 1110.19) to "develop, propose and implement an approved regional program for comprehensive and integrated environmental protection activities; be responsible for accomplishing national program objectives within the region; and exercise approved authority for implementation plans." On June 28, 1971, the regional offices were reorganized along the more functional lines of the national office.

EARLY OBSTACLES FACED BY THE EPA

There is no doubt that the development of an integrated organization has been a difficult task. William Ruckelshaus commented that "when I first came into this job, I said it would take three months to get settled. . . . For nine months we've put up with people's jobs changing and with uncertainty about who will be located where and who will be responsible to whom." [1]

Some of the chief obstacles initially facing the new organization were: (1) physical separation of employees—originally there were ten locations in Washington, D.C., alone; (2) pressures from statutory timetables and other sources to get on with the job; (3) lack of senior career administrators and key technical personnel in several program areas; (4) delay in determining precisely which people, funds and facilities belonged to EPA; (5) difficulty in realigning budgets; (6) establishing jurisdictions among organizational units; (7) individual resistance to change; (8) reluctance by central offices to surrender powers to regional counterparts; and, (9) attempting to decentralize before centralization had been achieved. During the first year of its existence, EPA tackled these obstacles while carrying out its other duties as well.

According to Howard Messner, EPA Deputy Administrator for Administration, some of the benefits which the organizational changes were intended to effect were tighter administrative control, freer communication, simplified lines of authority, and greater accountability.[2]

Lynton Caldwell, Professor at Indiana University, reviewed for the conferees the forces leading to the creation of CEQ and EPA and recommended another organizational change at the National level—the establishment of an Environmental Reconstruction Agency. Caldwell's explanation of how this agency would be able to respond to environmental problems of the future can be found in the following papers.

CHANGING STATE ENVIRONMENTAL MANAGEMENT

According to a report issued by the Council of State Governments, approximately forty state legislatures enacted laws to preserve environmental quality during 1971. Actions were taken on a broad spectrum of programs , from wetlands protections, land-use controls, and noise regulations to administrative reorganizations. The Citizens Conference on State Legislatures reported that six states now allow citizens to file suits against polluters—Michigan, Connecticut, Florida, Massachusetts, Minnesota, and Nebraska.

As with the federal government, states have responded to the increasing concern of their citizens over environmental quality by adopting larger appropriations for environmental programs as well as more comprehensive environmental controls. Most of these actions have occurred since 1970.

As states assume greater environmental responsibilities, they are frequently inhibited by archaic governmental frameworks. Legal authority is frequently inadequate. Institutions created in the 19th century are ill-equipped to deal effectively with environmental problems which are complex and interdependent and have radically changed in scope over the past twenty years. Elizabeth Haskell reports that "Not only were environmental institutions coming under fire, but, by 1970, a general complaint has surfaced that government agencies of all kinds and at all levels were not able to respond effectively and swiftly to new social needs. But, this 'institutional lag' of organizations behind problems is particularly unacceptable when a politically popular issue, such as the environment, is affected." [3]

Even when the role of states in environmental management was more restricted, management responsibility was dispersed throughout the administrative organization. In general, state organizations were bulky assemblages of elected and appointed boards and agencies. Environmental responsibilities were fragmented between several boards, e.g., Conservation Commission, Natural Resources Council, Development Commission, Health Commission, and the like. These boards usually possessed policy-making duties, if not full administrative responsibility.

As states began to centralize or integrate their organizations, environmental functions came to reside in a few state agencies such as the Health Department, or Conservation Department. Reorganization efforts generally developed along six main themes: "(1) concentration of authority and responsibility, (2) departmentalization or functional integration, (3) undesirability of boards for purely administrative work, (4) coordination of the staff services of administration, (5) provision for an independent audit, and (6) recognition of governor's cabinet." [4]

By 1912, all states had created an administrative unit for health functions.[5] The first health departments were controlled by a board or commission. Some were interagency boards, drawn from other state agencies, other boards were composed of private citizens, representing both political parties, appointed for a specific term by the Governor. Gradually, however, the boards tended to lose their administrative authority and to become predominantly advisory bodies.

While no pattern existed for the functions performed by state health departments, the more common functions as reflected in the administrative structure were: (1) vital statistics, (2) communicable disease control, (3) public health laboratories, (4) industrial public health, (5) food and drug inspection, and (6) environmental sanitation. The environmental sanitation section often included activities in the areas of water pollution, sewage disposal, solid waste disposal, and the like. While this section often consolidated existing pollution control staff responsibilities in a single division, the division was often not particularly prominent in the departmental structure and competed with many other programs for staff and funds.

SHARING IN THE ENVIRONMENT

Sharing the environmental functions at the state level, conservation departments contained programs for fish, wildlife, forests and parks. These programs are often considered "promotional" programs because they generally regulated use of natural resources while encouraging use as well. The various sportsmen—fishermen, hunters—as well as resource-extracting industries—such as lumber companies—frequently developed close working relationships with the agency.

Federal legislation in the 1950's provided financial incentives to encourage states to form Air Pollution Control Boards and Water Pollution Control Boards. The boards were established either as independent agencies or as part of the Health Department. Their principal functions included policy-making, standard setting, and appeals. Most of these boards are still in existence due to federal requirements, although many other of the state boards and commission have been eliminated or consolidated. Most recently members of these boards from private industry and municipalities have been attacked in regard to possible conflict of interest.

Beginning in 1970 and following the lead of the federal government in establishing a separate environmental agency (the U.S. Environmental Protection Agency), several states followed with separate departments of their own (see Table). It should be noted here that these recent reorganization did not succeed in centralizing all environmental functions under one agency. Other state agencies often hold responsibilities for such activities as: soil and water conservation, agriculture, forestry, fish and game, state parks, public lands, natural resources, water resources, mines and geology, and extension services.

The reorganization of environmental functions by states have generally been made for the following reasons:

—Consolidate fragmented activities to make program administration match the integrative way problems occur in the environment.

—Reduce the proliferation of boards and commissions to make state government more manageable, and in some cases change their role and composition to 'professionalize' state environmental policy-making, and make policy-makers more responsive to elected leaders and the public.

—Transfer pollution programs from the health department to broaden pollution concerns beyond health.

—Create a stronger regulatory role for the state and an agency advocate for the environment.

TABLE OF STATE ENVIRONMENTAL DEPARTMENTS

Alabama—Department of Conservation and Natural Resources
Alaska—Department of Environmental Conservation
Arkansas—Department of Pollution Control and Ecology
California—Department of Environmental Protection
Connecticut—Department of Environmental Protection
Delaware—Department of Natural Resources and Environmental Control
Georgia—Department of Natural Resources
Illinois—Environmental Protection Agency

Iowa—Department of Environmental Quality
Maine—Department of Environmental Services
Maryland—Maryland Environmental Service
Minnesota—Pollution Control Agency
Nebraska—Department of Environmental Control
Nevada—Environmental Protection Commission
New Jersey—Department of Environmental Protection
New York—Department of Environmental Conservation
Ohio—Environmental Protection Agency
Oregon—Department of Environmental Quality
Pennsylvania—Department of Environmental Resources
South Dakota—Department of Environmental Protection
Vermont—Agency of Environmental Protection
Washington—Department of Ecology
Wisconsin—Department of Natural Resources

—Design a new environmental department that will be more publicly visible, thus demonstrating the state's commitment to environmental protection and rallying environment interest groups to form a stronger political base for environmental control.
—Increase accountability of public officials and public programs.
—Facilitate administrative efficiencies."[6]

Changing organizations for environmental management has taken different forms in different states. The actions of several states, such as Minnesota, have simply combined the pollution control programs into a single agency. Other states, notably Wisconsin and New York, have attempted to consolidate both pollution control and natural resource programs. A more detailed explanation of the alternative organizational structures and their relative merits can be found in Elizabeth Haskell's paper, "State Governments Tackle Pollution," later in this chapter.

Internal organization of these agencies is based on either program categories (e.g., air, water, solid waste) or function (e.g., planning, research, standard setting, enforcement). An example of the functional organization adopted in Ohio is shown in Figure 1.

ORGANIZING LOCAL ENVIRONMENTAL MANAGEMENT EFFORTS

As local governments have assumed responsibility for various environmental programs, such as water supply, sewage treatment, solid waste disposal, and parks, they have traditionally established distinct organizational units based on those programs, e.g., Sanitation Department, Water Department, Refuse Department or Parks Department. Other local departments with environmental responsibilities might include the Planning Department, Health Department, and Inspections Department. Attempts at consolidation led to the creation of Public Works Departments that include some or all of the following activities: engineering, street cleaning and maintenance, traffic control, street lighting, water, sewage, refuse, inspectional services, and equipment management (see Figure 2). Pollution control functions are generally located in the local health agency, either city or county sponsored (see Figure 3).

Currently, environmental activities remain fragmented between several

FIGURE 1.—ORGANIZATIONAL STRUCTURE OF THE OHIO ENVIRONMENTAL PROTECTION AGENCY.

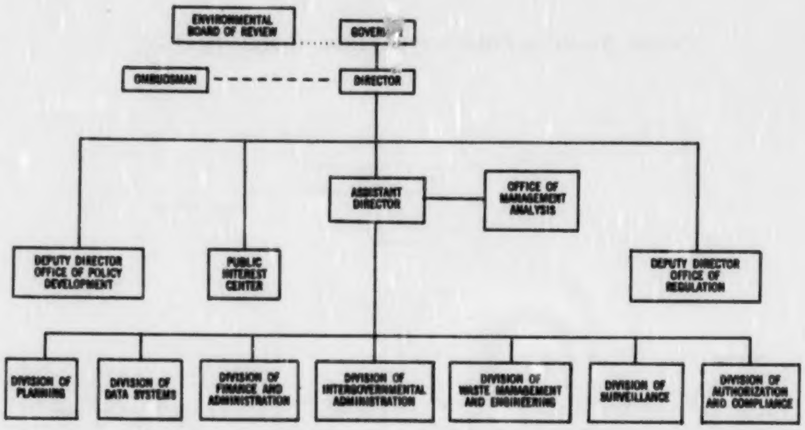
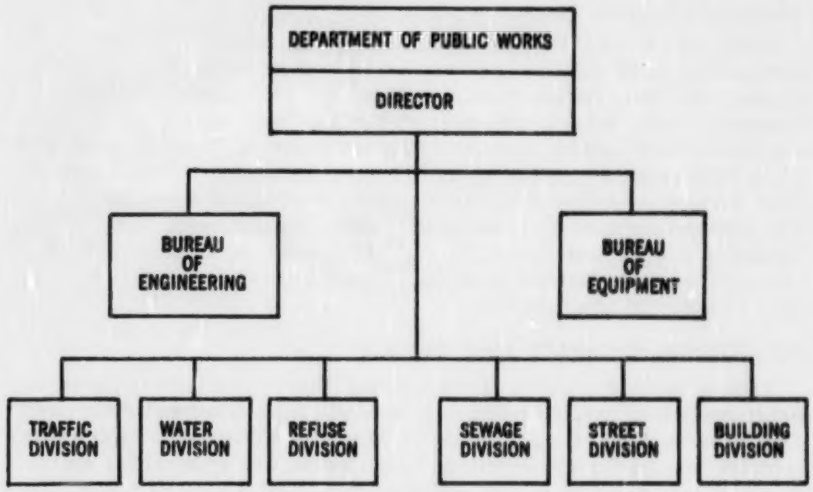
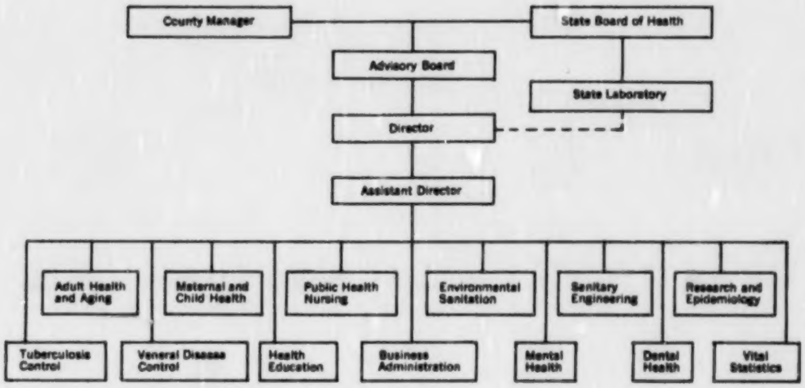

ENVIRONMENTAL BOARD OF REVIEW
GOVERNOR
OMBUDSMAN
DIRECTOR
ASSISTANT DIRECTOR
OFFICE OF MANAGEMENT ANALYSIS
DEPUTY DIRECTOR OFFICE OF POLICY DEVELOPMENT
PUBLIC INTEREST CENTER
DEPUTY DIRECTOR OFFICE OF REGULATION
DIVISION OF PLANNING
DIVISION OF DATA SYSTEMS
DIVISION OF FINANCE AND ADMINISTRATION
DIVISION OF INTERGOVERNMENTAL ADMINISTRATION
DIVISION OF WASTE MANAGEMENT AND ENGINEERING
DIVISION OF SURVEILLANCE
DIVISION OF AUTHORIZATION AND COMPLIANCE

FIGURE 2.—SAMPLE PUBLIC WORKS DEPARTMENT ORGANIZATION


DEPARTMENT OF PUBLIC WORKS
DIRECTOR
BUREAU OF ENGINEERING
BUREAU OF EQUIPMENT
TRAFFIC DIVISION
WATER DIVISION
REFUSE DIVISION
SEWAGE DIVISION
STREET DIVISION
BUILDING DIVISION

Source: ICMA, Municipal Public Works Administration, 1957, p. 11.

FIGURE 3.—DADE COUNTY (FLA.) HEALTH ORGANIZATION


County Manager
State Board of Health
Advisory Board
State Laboratory
Director
Assistant Director
Adult Health and Aging
Maternal and Child Health
Public Health Nursing
Environmental Sanitation
Sanitary Engineering
Research and Epidemiology
Tuberculosis Control
Venereal Disease Control
Health Education
Business Administration
Mental Health
Dental Health
Vital Statistics

Source: ICMA, Community Health Services 1968, p. 230.

agencies at the local level. Fragmentation occurs within municipal governments, as well as between municipal governments and other local jurisdictions, e.g., counties and regional bodies. However, just as previously seen at the federal and state level, many local governments are experimenting with new organizational units in an attempt to deal more effectively with environmental problems.

There are basically five organizational approaches utilized by local governments to consolidate environmental programs within the municipal government. These include creating a separate "line" agency, creating a separate "staff" agency, expanding an existing "line" agency, expanding a separate "staff" agency, and developing some type of "team" management. These distinctions are useful for the following discussion, although they often become somewhat nebulous when describing actual situations. The approach selected by a particular locality depends upon state enabling legislation and/or local charter, the size of the entire organization, nature and extent of environmental problems, political interest, staff expertise, and a number of other factors.

NEW YORK'S SEPARATE LINE AGENCY

Perhaps the best example of the separate "line" agency, or one with direct operational responsibility, is New York City's Environmental Protection Administration. Created in March of 1968, this "superagency" contains bureaus for air, water and sanitation as well as a central staff. In addition to pollution control activities, New York City's EPA provides the basic municipal services such as water and refuse collections. The budget of the agency in 1973-74 is nearly $500 million for operating expenditures and approximately the same amount for capital expenditures. Agency staff exceeds 21,000 employees, including 10,000 sanitation workers. At the Conference, First Deputy Administrator of the City of New York's EPA Paul Zimmerman described the strengths of the agency staff expertise and ability to see beyond the tremendous everyday problems and maintain a broad environmental perspective. He identified the key components to a successful program in New York City to be support from top management, extensive citizen involvement and education, and effective legislation.

Zimmerman indicated that the agency had experienced some internal conflict, for example, over a proposal to construct the largest incinerator in the world, as well as with other municipal agencies, e.g., Department of Transportation and the Planning Commission. In response to a question probing the status of the EPA in relation to other departments, Zimmerman explained that EPA was of equal status to other departments. Their role is seen to be environmental advocate. It is the role of the Mayor and Board of Estimate to set the priorities and resolve policy conflicts between agencies.

Additional examples of the "little EPA's" can be found in Chicago, Illinois; Washington, D.C.; and Huntington, New York. Simi Valley,

Lynton Caldwell states that "the ultimate task of environmental quality agencies at all political levels, and especially at the top of each administrative hierarchy, is a task of synthesis."[7] He concludes that the current fragmented responsibility for environmental programs throughout several agencies is not conducive to the task of synthesis, and therefore new organizational structures are needed. The following discussion examines current organizational developments at the federal, state and local levels. Since experience with new environmental organizational units is somewhat limited in scope as well as time, little evaluation or analysis has been made. It is all the more important, therefore, to stimulate a dialogue on the subject of organizing for environmental management so that experiences can be shared and previously encountered successes or problems can be sought or avoided.

CONSOLIDATING FEDERAL ENVIRONMENTAL FUNCTIONS

The administrative organization of environmental functions has long been a concern of the federal government existing prior to the creation of the Department of the Interior in 1849. In more recent times (1932) President Hoover submitted a plan to Congress proposing to transfer the Corps of Engineers' civil functions to the Department of the Interior. Later, in 1937 the President's Committee on Administrative Management recommended that the Department of the Interior be retitled Department of Conservation. This, too, failed. Other minor changes were advocated by the Hoover Commissions of 1949 and 1955. This gradual development of environmental activities is documented in the first paper in this chapter.

A second organizational alternative is to establish a separate staff agency. In many cases this may comprise from one to several staff members assigned in the office of the chief executive officer to be responsible for environmental programs. The role of this staff person or agency usually involves research, program planning and development, program coordination, policy advice, public relations and liaison with other governmental jurisdictions. Examples of this type of organization can be found in Palo Alto, California, which established an Environmental Planning Office. Montgomery County, Maryland, and Waco, Texas, have also established separate environmental planning units. University City, Missouri, and Manhattan Beach, California, have Environmental Control Officers in the Office of the City Manager. In addition, Fairfax County, Virginia, and San Jose, California, have created the position of Environmental Coordinator.

A third type of organizational change adopted by local governments to increase the effectiveness of environmental programs is the expansion of an existing line department to include responsibility for environmental programs. For example, the City of Addison, Illinois, has staffed a Pollution Control Officer position in the Engineering Department. His function is to enforce environmental ordinances and review all pollution control equipment in the city.

Fourth, local governments may expand the responsibilities of a staff agency to include environmental considerations. Perhaps one of the most popular alternatives at this time is to add an environmental section to the planning staff. Richard Gray, City Manager of Norman, Oklahoma, explained that environmental concerns are a part of every city program, and, therefore, the key to coordinating environmental concerns among all city departments rests in the planning function. For that reason, the City of Norman hired an environmental planner in the Planning Department to serve as executive secretary to the City's Environmental Control Board, a citizen advisory body, and to provide direct input into the planning process. Gray recommends that, in small cities that cannot afford a large environmental staff, hiring an environmental planner may be the most realistic alternative.

Other larger cities have adopted this approach also. Inglewood, California, has a three-person environmental control section within the planning department. Inglewood City Manager Douglas Ayres explains that this will help bring environmental concerns into the city's decision-making process. In addition, Phoenix, Arizona, recently appointed an environmental planner to the planning department staff. Finally, Dallas, Texas, has an environmental planning section located in the Planning Department's Urban Design Division.

THE TEAM APPROACH TO ENVIRONMENTAL MANAGEMENT

A fifth method of organizing for environmental management is the "team" approach. According to Mayor Beverly Briley, rather than establish another agency, the Metropolitan Government of Nashville-Davidson County formed a management team consisting of an assistant to the mayor, an associate professor in the Graduate School of Management of Vanderbilt University, and the Chairman of the Special Environmental Committee of the Nashville Area Chamber of Commerce. The key working unit of the program is an environmental management task force, an interdepartmental team consisting of five department heads of the Metropolitan, including the Executive Director of the Planning Commission, Director of Planning, Director of Health, Director of Public Works, and Director of Law. The "team" has a three-person, full-time staff. The tasks of the "team" are to identify, research, prepare and implement solutions to community environmental problems and to coordinate Metro environmental activities. A more complete explanation of this program is contained in the paper by Project Historian Dick Battle.

The City of Ann Arbor, Michigan, has set up a similar Administrative Environmental Committee, consisting of key department heads, to oversee city operations that involve environmental considerations and set environmental standards.

In the final analysis, City Manager Gray states, "It is most important that the city council as well as the city administration evidence a strong commitment to generate both environmental questions and answers. They must spread an awareness and concern for the environment throughout the entire city government structure. There should be commitment and participation by all departments of the city and all boards and commissions. It is most important that the chief administrative officer, through his attitude, help meld the various boards, committees and city council into an integrated and committed whole. The manager's and mayor's philosophy and interest will, to a great extent, determine how successfully these groups work. . . ."

One final alternative exists for local governments to deal with environmental problems that extend beyond municipal boundaries—a regional organization. There are a variety of organizational structures available for regional environmental management. These include but are not limited to intergovernmental service agreements, regional planning commissions, councils of governments, special districts, metropolitan councils, metropolitan county and metropolitan federations. Some of the weaknesses in current regional organizations and highlights the key components that a regional environmental management system should contain are summarized in a presentation given by Edwin Coats which wraps up this chapter.

Additional discussion of these alternatives and the future role of regionalism in the federal system can be found in Chapter VII, Intergovernmental Relations and Environmental Management.

EMERGING TRENDS

Since 1970, there has been definite movement in federal, state, and local governments toward reorganizing environmental management by consolidating environmental activities. In most cases this is probably not a result of adding completely new environmental activities so much as the desire for greater environmental visibility, advocacy and coordination.

It seems likely that this trend will persist for at least the next five to ten years for two reasons. First, institutional changes usually lag behind the conditions that give rise to the changes. These conditions, chiefly public concern over environmental matters, continue to maintain their relevance; and, therefore, additional organizational changes are likely to continue. Second, federal environmental requirements for state and local governments that encourage institutional change have increased, and no doubt will continue to increase. For example, as requirements for environmental impact assessment expand to cover more activities (from only federally financed projects to all actions that may impact on air quality), more state and local governments will find it advantageous to officially incorporate the process within their organizational structures. Also, the reassertion of states into land-use decision making, plus imminent insertion of the federal government, will result in significant organizational changes. Finally, the implementation of Section 208 of the Water Pollution Control Act Amendments of 1972 calling for areawide water planning and management could have a tremendous impact on the shape of future regional organizations.

It is difficult to predict the precise organizational forms that will emerge in the future because the field of environmental management is changing so rapidly. Furthermore, it is difficult to generalize since organizational structures are responsive to the particular needs of their jurisdictions. Finally, the absence of any meaningful evaluation of the alternative organizational approaches for environmental management means that there is little overall direction or guidance for state and local governments as they consider making changes.

Notes for Chapter III

[1] Robert Gillette, *Science*, August 20, 1971, p. 703.

[2] *Ibid.*, p. 707.

[3] Elizabeth Haskell, *Managing the Environment: Nine States Look for New Answers*, April. 1971.

[4] A. E. Buck, *The Reorganization of State Governments in the United States* (New York: Columbia University Press, 1938), p. 20.

[5] Wilson G. Smillie, *Public Health Administration in the United States* (2nd ed.; New York: Macmillan Co., 1940), p. 369.

[6] Elizabeth Haskell, op. cit., pp. 11-12.

[7] Lynton Caldwell, "Environmental Quality as an Administrative Problem," *An Anthology of Selected Readings for the National Conference on Managing the Environment*, p. 111-11.

III.1 NEPA and the environmental movement: a brief history

Lynn G. Llewellyn *
Clare Peiser

The purpose of this paper is threefold: (1) to trace a few of the critical events which led up to the environmental crusade of the past few years; (2) to review the Federal Government's response to public pressure on behalf of the environment, particularly from mid-1968 to mid-1970; and (3) to examine the environmental movement today—what the critics think of it and some of the obstacles it must overcome.

The opening section is an attempt to identify some of the forces at work during the 60's which helped to mold the environmental policies of the current decade. Clearly, this is not a simple task. The environmental movement evolved from a complex interplay of decision makers, institutions, critical events, mass-media coverage and heightened public awareness of ecological problems. A definitive discussion of these factors is far beyond the scope of the opening section; it does, however, touch upon three key elements in the equation: some highly visible environmental mishaps, changing priorities as reflected in public opinion polls on environmental issues, and the influence exerted by prominent conservationists and the mass media.

In many ways the second section is a continuation of the opening theme. It charts the activities of Congress and the Administration from the 1968 Presidential election until the 1970 Congressional elections, a critical period in the development of environmental policy. As this section suggests, many of the laws now on the books are as much the result of political image-building and jurisdictional disputes as they are of more altruistic motives. The primary focus of attention—here, and in the final section—is the National Environmental Policy Act (NEPA), surely one of the most controversial pieces of legislation passed in recent years.

The paper concludes wtih a critique of NEPA's first one thousand days. In particular it examines the requirement for environmental impact statements which has created a furor in the courts, and some of the challenges facing the environmental movement today.

Sources of environmentalism: some critical incidents

Generally speaking, a political issue becomes salient if (a) it is highly visible, (b) the general public is *aware* of the problem, and (c) the issues arouses *emotion* among an influential segment of the populace (e.g., the mass media, opinion leaders, pressure groups, the political elite, etc.). Thus, with the exception of localized concern about smog, and the activities of conservation groups, the environment was not a major focus of attention until the last decade. During the early and mid-60's Americans were primarily concerned about the threat of nuclear war with the Soviet Union (viz., the Cuban missile crisis), the Indo-China war, communism, inflation and unemployment. racial tensions and crime-in-the-streets.[1] Exactly what happened to change the public's sense of national priorities is not entirely clear, but two events—the *Torrey Canyon* episode and the Santa Barbara oil spill—were probably instrumental in drawing attention to the fragile nature of our environment.

In March, 1967, the tanker *Torrey*

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*Prepared by Lynn G. Llewellyn, Research Psychologist, and Clare Peiser, Operations Research Analyst, with the Technical Analysis Division of the National Bureau of Standards.

Canyon, carrying 119,000 tons of crude oil, broke apart in rough seas off Land's End, England. Frantic efforts to prevent the spill from doing extensive damage only underscored the relatively unsophisticated techniques available to cope with oil pollution of this magnitude. Television audiences throughout the United States witnessed the use of everything from detergents to napalm, all of which proved unsuccessful. Ultimately, great quantities of oil enveloped wide expanses of English beaches, killing countless shore birds and crippling the coastal tourist trade.[2] The testimony of British investigators was illustrative of the worldwide concern about the high probability of future disasters:

> The risk of accident is a very real one. In the three years preceding the wreck of the *Torrey Canyon*, 91 tankers were stranded in various parts of the world, while 238 were involved in collisions either with tankers or other vessels. Over the world at large, tankers thus have been involved in potentially serious accidents on an average of about twice a week for the past three years (prior to 1967). Sixteen of the 329 ships which were concerned became total losses; in nine of the collisions fires broke out in one or both ships; and in 39 cases cargo spillage or leakage occurred.[3]

Oil spill hits home

Another type of oil spill probably did more to shake the American public out of its complacency than any other event in recent history. In January, 1969, an off-shore drilling rig in Santa Barbara Channel struck a large oil deposit but, in so doing, set off a catastrophic chain of events. The resultant blow-out cracked the ocean floor, allowing several million gallons of oil to escape. Santa Barbara, an erstwhile garden spot, became, at least temporarily, a massive ecological problem area. Despite round-the-clock efforts to contain the slick, miles of coastal waterways and beaches became coated with crude oil. Untold numbers of waterfowl and other aquatic life were killed.

Intensive coverage by the mass media attracted widespread attention to the plight of Santa Barbara. Television, in particular, was responsible for arousing public indignation over the incident as it depicted the sight of youthful volunteers trying valiantly to remove oil from dying shore birds.

Also contributing to the high level of public interest in the Santa Barbara incident was the fact that the Secretary of the Interior, Walter Hickel, had only recently been the object of a bitter controversy over his confirmation. Faced with some difficult choices, Secretary Hickel ordered the drilling shut down. In his words "the behind-the-scenes battle . . . became a turning point in the relationship between government and industry."[5] Hickel also makes the interesting observation that the authority to call a halt to off-shore drilling in the Santa Barbara Channel was not derived from any statute governing pollution damage; rather, it was because valuable oil was being wasted. Clearly, the Department of the Interior needed a better mechanism for responding quickly to oil spills.

> Cleaning up a spill cannot wait for a court judge to decide who is liable. It has to be done before the pollution kills the wildlife and ruins the beaches. For this reason I demanded that all companies who hold drilling leases on the outer Continental Shelf accept liability for cleanup *even before the cause of a spill* is determined. This became known in short as "absolute liability without cause." It also became one of the most controversial topics in both the executive and legislative branches of the federal government.[6]

There were other occasions on which Mr. Hickel crossed swords with the oil industry during his tenure as Secretary of the Interior, including a landmark court battle with the Chevron Oil Company. In February, 1970, oil spilled into the Gulf of Mexico when a Chevron drilling rig caught fire. A subsequent investigation revealed that a storm choke had not been installed, a serious violation of safety regulations. After closing down the oil field, safety inspectors found similar violations in a significant proportion of the Chevron rigs. The court fined the company one million dollars but, more important (according to Mr. Hickel) was the amount of publicity the case received from the newspapers.[7]

Although the discussion of critical incidents has been confined to oil spills, it should not be construed that oil poses a greater threat to the environment than other forms of pollution: from the standpoint of the effect on human populations, toxic substances such as lead and mercury may constitute a greater hazard. However, oil slicks generally are more easily perceived than is the presence of toxic substances and visibility precipitates and intensifies public indignation. In the final analyses, the loss of the *Torrey Canyon*, the Santa Barbara spill, and other subsequent incidents appeared to have considerable impact on public opinion. Data reflecting public awareness are reported in the next section.

Changes in public opinion

There was little public commitment on a national scale to ecological problem solving during the early stages of the last decade. Despite the activities of various conservation groups (e.g., the Izaak Walton League sponsored a "Clean Air Week" in 1960) few Americans recognized the magnitude of environmental degradation.[8] As late as the Fall of 1964, a list of "concerns" of the American public compiled by the Gallup organization (from open-ended questions) contained no reference to the environment.[9] Within less than a year however, this picture began to change.

Political influence is a two-way street: public opinion has an effect on the decisions made by government officials, and the reverse is also true. Each stimulates the other. As an example (although a cause-effect relationship cannot be established), President Johnson spoke about the importance of beautifying America in 1965, and marked changes in public attitude subsequently occurred. Late that year 43 percent of a Harris poll sample expressed concern about the pollution of rivers and streams.[10] Another index of increasing public interest was the publication of 350 articles on pollution by the *New York Times*, more than twice the number published in 1964. It is not surprising that four important pieces of environmental legislation—the Water Quality Act, the Water Resources Act, the Rural Water Sewage Act, and the Highway Beautification Act—were also passed in 1965.

From 1965 through 1968. polls conducted by the Opinion Research Corporation continued to reflect increasing awareness of pollution. For example, the percentage of individuals who thought that water pollution was a "serious" problem increased from 35 to 58 in approximately three years. Similarly, concern over air pollution climbed from 28 percent to 55 percent.[11] Comparable data were not available after 1968; however, a 1969 poll conducted on behalf of the National Wildlife Federation showed that more than eight out of every ten individuals surveyed were at least "somewhat concerned" about environmental deterioration. Another poll conducted in 1970 indicated that 90 percent of those sampled were concerned about water pollution.[12]

While it is dangerous to generalize from several different polls which varied in terms of sample size and question content, at least one conclusion appears justified. The general public was becoming increasingly adamant in its demand for more positive action in the fight against pollution.

Another measure of public interest in the environment was the accelerated growth of conservation and related pressure groups during the last decade. The size of the Sierra Club increased from 15,000 to more than 85,000; more dramatically, its Eastern membership went from 750 to 19,000 according to Trop and Roos.[13] The collective political "clout" of other similar organizations (such as Friends of the Earth, the Conservation Foundation, the National Wildlife Federation, the Nature Conservancy, and the National Audubon Society) can be directly attributed to more members, larger financial contributions and a receptive public.

Opinion leaders and mass media

In its own way, Rachel Carson's *Silent Spring* was as critical a contributor to the growth of an environmental ethic as the Santa Barbara incident. Frank Egler, a noted plant ecologist went so far as to say that

> The years 1962 and 1963 are so completely dominated by one person and one book that historians of the future may well refer to this period as the Carsonian Era . . .".[14]

A best seller for many months, *Silent Spring* succeeded in acquainting the public with the dangers of pesticides—something that a number of concerned scientists had been unable to do. As Egler states, there was increasing apprehension

> . . . as to the side effects, the indirect effects, and the long term effects of . . . pesticides, not only on the target organisms themselves, but on other organisms, as the pesticides moved through the environment interacting among themselves, following food chains as predator ate predator, and acting upon man himself, as in cancer-producing substances, in ways most difficult to document in a factual manner.[15]

Government policies governing the use of pesticides did not change significantly for almost another decade; however, the fact that change occurred at all is due at least in part to *Silent Spring*.

The popular appeal of *Silent Spring* marked the beginning of an informal alliance between leading conservationists and the mass media. From 1965 to 1970 the reading public was bombarded with environmental literature, whose basic theme was a dying plant. Commoner's *Science and Survival*, Ehrlich's *Population Bomb*, Ewald's *Environment for Man*, and the Rienows' *Moment in the Sun* were among the most influential books of that period.

As time passed, there were predictable reactions to the constant litany of "doomsday" predictions. For some individuals, fears of a nuclear Armageddon were replaced by anxiety about "killer smogs" (T. S. Eliot's version of a world ending "not with a bang, but a whimper" seemed suddenly prophetic). Others became confused by both the quantity and the ambiguity of available informaion (e.g., the debate over phosphate detergents) which, in turn, resulted in loss of interest, apathy, disbelief, and occasionally, denunciation of environmental spokesmen.

Unfortunately, the proportion of the general public for or against sweeping changes in environmental policies could not be ascertained. In the absence of rigorous, in-depth national attitude surveys, the size of these groups, their composition, and intensity of feeling (or degree of commitment) was subject to misinterpretation. As noted in the previous section, the polls reflected growing concern over pollution, but not how much people were willing to sacrifice (i.e., increased taxes, rising costs associated with anti-pollution devices, etc.) for clean air and water. Other indices were equally unreliable. For example, letters to newspapers and to politicians are often written by a disproporionatley small segment of the ideological spectrum.[16] In particular, published letters have already been screened, hence, a frequency count of such letters might well reflect the philosophy of the newspaper more than public sentiment.

Support from the media

The last point relates to another potentially dangerous measure of attitudinal climate—that of media coverage. At the close of the last decade most television and newspaper accounts of environmental controversies appeared to support conservationists." Both media devoted extensive coverage to local confrontations between ecologists and developers, citizen groups and highway officials, wilderness advocates and mining interests, and so on. The coverage problem was mentioned in a recent interview with an official of the American Petroleum Institute.

> "It sometimes seems that I see David Brower (president of . . . Friends of the Earth) every other time I turn on my TV set," she says. (The personable and articulate Brower has, in fact, appeared frequently in such forums as *The Dick Cavett Show* and in newsbroadcasts). "But it's very seldom that I see an oil company or electric utility executive." [18]

At the same time it may be noted that large sums are spent on institutional advertising for the purpose of image building with respect to environmental affairs.

Some observations may be made without taking sides in the dispute over media coverage. As Joseph Klapper, Director of Social Research for the Columbia Broadcasting System, has pointed out, although most research indicates that the mass media are not very effective at changing existing attitudes, they can stimulate the formation of *new* attitudes by conveying information to an uncommitted or dissatisfied audience—one "predisposed" to change.[19] Clearly, an audience receptive to ecological appeals coalesced during the period under discussion although we don't know its size. Indeed, if media coverage was as biased as environmental critics contend, then the environmental movement might have appeared more pervasive than it was. This point will be addressed in a later section.

In summary, the environmental *Zeitgeist* of the late 1960's was not the result of any single factor; rather it was the interaction of multiple factors. *Time* magazine, for example, suggested that the environment represented a new challenge, a problem which American skills and "know-how" might be capable of solving. By the same token, however, the environmental movement" . . . represented a creeping disillusionment with technology, an attempt by individuals to reassert control over machine civilization." [20] Thus far, the present discussion has touched briefly on the impact of certain critical events and the influence exerted by conservationists, public opinion, and the mass media. In the next section, attention is focused on the role played by the Federal Government specifically, two years of environmental legislation and what influenced it.

Government responds: quest for environmental supremacy

As public pressure on behalf of the environment continued to mount during the late 60's, a number of Senators and Congressmen contended for leadership of the environmental crusade. The competition became even more keen in the wake of the 1968 elections when the White House entered this arena. Nonetheless, neither party's 1968 platform had devoted much space to ecological problems. The Democrats outlined the need for clean air, clean water, and improved methods of waste disposal in a brief section which also contained references to agriculture and recreation; the Republicans covered pollution in one sentence.[21]

Given the increasing public concern it is somewhat surprising that neither party's platform paid much attention to the environment. Clearly, greater importance was attached to other issues such as "law and order" and Vietnam. Another factor is mentioned in Scammon and Wattenberg's analysis of the 1968 elections: in terms of national politics, ecology is akin to "motherhood," and nobody is going to campaign against it.[22]

If Scammon and Wattenberg are correct, then the competition for political dominance in environmental affairs might have been motivated somewhat by the desire to be perceived as the champion of "motherhood." Thus, Republicans and Democrats alike were casting about for issues which might be important not only in the 1970 Congressional elections, but in 1972 as well, and environmental quality appeared to be a relatively "safe," yet attractive issue. This factor, together with traditional rivalries between Congressional Committees and between high ranking Administration officials, furnishes the background for much of the environmental legislation of the last few years. As political scientist J. Clarence Davies has noted:

> One can search the *Congressional Record* in vain for a defense of foul air or dirty water. One can similarly search in vain for a metropolitan area which does not suffer from the fumes of automobiles, from belching smokestacks, or from untreated sewage flowing into its lakes and streams. The explanation for the gap between intention and reality lies to a great extent in the realm of politics.[illegible]

In the remainder of this section an attempt will be made to review the anti-pollution measures initiated by members of the 91st Congress and the Nixon Administration. This discussion is essentially limited to the period separating the 1968 and 1970 elections, primarily to highlight proximate events leading to the National Environmental Policy Act. The sequence of events can also be followed in Figure 1 which provides a month-by-month picture of environmental initiatives taken by Federal policy makers.

Fall 1968

Introduction. John Steinhart, the Associate Director of the Marine Studies Center at the University of Wisconsin, has emphasized that jurisdiction over environmental legislation is somewhat confused in the House of Representatives.[illegible] Part of this problem is definitional in nature: "environment" is a catch-all concept with ill-defined boundaries. Responsibility for environmental quality could equally well be placed in any one of several standing committees (e.g., Agriculture, Commerce, Interior and Insular Affairs, Merchant Marine and Fisheries, and possibly others) depending on what facet of the environment was under consideration. The guidelines governing committee jurisdiction are sometimes fuzzy, and overlapping responsibilities frequently result. The situation is also affected by the activities of powerful pressure groups, and the need to insure that constituents are not adversely affected. The important role played by committees was stressed in the recently published *Almanac of American Politics:*

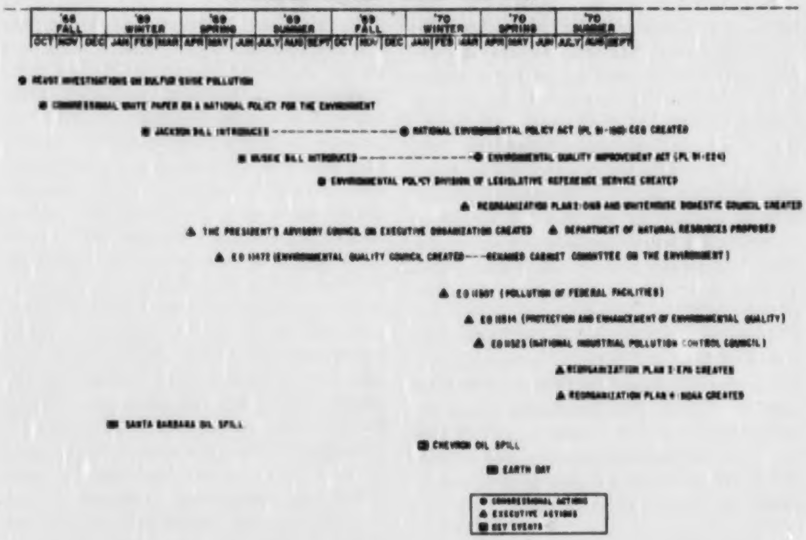
> Lawyers and pollsters know that the power to shape the question is, by and large, the power to determine the answer. Congressional committees, by hammering out the legislation which the Congress at large passes or rejects, do just that. . . . Committee chambers . . . are literally the back rooms where decisions of Congress are shaped.[illegible]

Reuss investigations. In September 1968, Congressman Henry Reuss, from Wisconsin's fifth district, conducted a hearing on research findings, related to sulfur oxide pollution. Reuss, like many others, was disenchanted with jurisdictional squabbles, duplication of effort, and lack of coordination within the Federal bureaucracy.[illegible] Later, as Chairman of the Government Operations' Subcommittee on Conservation and Natural Resources, he became known as a staunch ally of conservationists.[27] Furthermore, the Subcommittee's unique "watchdog" status allowed Reuss to challenge other Congressmen (such as Wayne Aspinall, Chairman of the powerful Committee on Interior and Insular Affairs) for pre-eminence in environmental matters.

White Paper on the Environment. Another important figure in the House of Representatives was Congressman Emilio Daddario. During the mid-60's, his Subcommittee on Science, Research, and Development focused attention on the problem of environmental quality. Of particular interest is the Subcommittee's 1968 report which called for

FIGURE 1

ENVIRONMENTAL POLICY-MAKING (1968-1970)



a systems approach to pollution problems. Daddario wanted the Department of Interior to assume responsibility for the coordination of Federal environmental programs. He also emphasized the need for an "Environmental Cabinet" chaired by the Secretary of the Interior and comprised of designated officials from other Federal agencies. For the first time a key phrase—"national policy for the environment"—appeared, one with far reaching implications for the nation's future.[28]

In October 1968, Congressman Daddario joined forces with Senator Henry Jackson to develop the "Congressional White Paper on a National Policy for the Environment." Davies suggests that, by calling for the establishment of a joint Congressional committee on environmental management, Jackson was trying to preempt Senator Edmund Muskie who had for some time been seeking the creation of a Select Senate Committee on Technology and the Human Environment.[29]

Winter 1968-1969

Introduction. As previously indicated, the Santa Barbara oil spill of January 1969 aroused considerable ire within the body politic. Pressure from the general public and the mass media became more intense for strong Congressional action. The Nixon Administration in general, and Secretary Hickel in particular, were quickly introduced to environmental realities at the national level.

Jackson Bill. In many respects, the Santa Barbara oil spill served as a catalytic agent in the competition for leadership in environmental matters. In February, Senator Jackson, Chairman of the Interior and Insular Affairs Committee, introduced a bill which eventually was to become the National Environmental Policy Act. Jackson's bill called for (a) the Department of the Interior to spearhead the conduct of environmental research and (b) the establishment of a three-man Council on

Environmental Quality reporting directly to the President.[20] A modified version of the bill eventually cleared the Senate in July of 1969.

Considerable credit should go to Michigan Congressman John Dingell for passage of the House version of Jackson's bill. According to John Steinhart, Dingell—Chairman of the House Subcommittee on Fisheries and Wildlife Conservation—introduced the bill "as an amendment to the 1946 Fish and Wildlife Act."[21] Steinhart viewed this as a ploy to get the bill assigned to Dingell's subcommittee for hearings over the opposition of Representative Wayne Aspinall. In the House version of the bill, the proposed Council on Environmental Quality would have consisted of five members in contrast to the three recommended in Jackson's Senate version. When this landmark piece of environmental legislation cleared the House of Representatives in September 1969, the number of proposed Council members again stood at three.

Spring 1969

Introduction. In the Spring of 1969, President Nixon brought the weight of the Executive Branch to bear on environmental affairs. While Jackson's bill was languishing in the Senate, Mr. Nixon issued Executive Order 11472 in May establishing an Environmental Quality Council (which should not be confused with the Council on Environmental Quality recommended in the Jackson bill). A month earlier the President's Advisory Council on Executive Organization had been appointed under the leadership of Roy L. Ash, then President of Litton Industries, Inc. The Council's proposal to establish a Department of Natural Resources is of prime interest, but a full discussion of its implications will be reserved for a later section since the Council's findings were not presented to the President until May 1970.

Executive Order 11472. With this action President Nixon launched an Environmental Quality Council and the Citizen's Advisory Committee on Environmental Quality, the former including the President as Chairman and the President's Science Adviser as the Executive Secretary. The Council was designed to advise and assist the Chief Executive on matters related to environmental quality. Specifically, it was to (a) review Federal plans and programs and recommend measures to insure that environmental effects were properly treated; (b) conduct studies and advise the President on policy matters related to recreation and beautification outdoors; (c) encourage mutual cooperation among Federal, State, and local organizations and strengthen public and private participation in environmental programs. The fifteen-member Citizen's Advisory Committee shared many of the same duties, including offering assistance and evaluating the extent to which progress was being made in the achievement of the Council's goals.[22] The Environmental Quality Council met for the first time in June 1969, with top priority assigned to such problems as air pollution, solid waste disposal methods, and the long range effects of DDT.

Steinhart has argued that the Environmental Quality Council was Mr. Nixon's initial attempt to establish "primacy" in the field of environmental affairs.[23] In Steinhart's opinion, however, the Council could never be an effective coordinating group because of its special relationship to the President and his belief that the Chief Executive should take action to solve problems, not merely "comment" on them.

Muskie Bill. As chairman of the Public Works Subcommittee on Air and Water Pollution, Senator Muskie is regarded by many as the leading environmental crusader in Congress. During the 60's he was responsible for some of the most important pollution control legislation of that era—notably, the Water Quality Act of 1965, the 1966 Clean Water Restoration Act, and the Air Quality Act of 1967. Muskie introduced the Environmental Quality Improvement Act in June of 1969 which called for:

- The development of criteria and standards to assure the protection and enhancement of environmental quality in all Federal and federally assisted public works projects and programs;
- the coordination of all Federal research programs to increase knowledge of the interrelationship between man and his environment;
- the creation of an Office of Environmental Quality and appropriate staff in the Executive Office of the President.[84]

The Senate was now confronted with competing bills (Jackson's and Muskie's) and the prospect of a protracted floor fight. Muskie, it seemed, was very concerned about the effect of NEPA on existing environmental programs. Fortunately, negotiations between Muskie and Jackson led to a compromise—provisions for the Council on Environmental Quality and the Office of Environmental Quality both survived, and a lengthy struggle over committee jurisdiction was avoided. Ultimately, Jackson's bill got through first, and Muskie's proposal was incorporated in proposed water pollution legislation.[85]

Summer 1969

Introduction. During the summer of 1969, Senator Jackson's bill passed both Houses of Congress and was sent to the President for signature. Also of significance to ecology-minded Congressmen was the creation of the Environmental Policy Division in the Congressional Research Service.

Environmental Policy Division. "Congressional concern for the quality and productivity of the physical environment" was the driving force behind the establishment of the Environmental Policy Division in September 1969.[86] Comprised of experts from the Natural Resources Division and other sections of the Legislative Reference Service, the Division was responsible for providing non-partisan information, advice, and assistance on legislative proposals. By creating the Environmental Policy Division, Congress could obtain "authoritative and objective policy analysis" in specific areas such as beuatification, land-use planning, natural resource management, air and water pollution, and protection of shorelines and estuaries.[87]

Fall 1969

Introduction. Secretary of the Interior Hickel had captured some of the headlines in late August by coming out with tough off-shore drilling regulations opposed by the oil industry. By fall, the public's attitude toward Hickel began to change, and, before long, he developed into a folk hero to many conservationists.

SCOPE. In December, Secretary Hickel and his assistants came up with a new concept known as SCOPE (Student Council on Pollution and the Environment). SCOPE was envisaged as a means of involving students in the fight against pollution; however, given the mood on many campuses, it was not an easy product to sell. Initially hostile and apprehensive about being "used" by the Government, many student leaders gradually became intrigued by the concept of an early warning system for pollution problems. Hickel told visiting students that "SCOPE will be a vehicle to open up a channel from the youth who care about the environment to those agencies in government who can do something about it on a national scale."[88]

Winter 1969-1970

Introduction. In many ways 1970 might be regarded as the year when government action on behalf of the environment finally began to overtake public demand to do something meaningful. The Jackson bill, better known as the National Environmental Policy Act of 1969, was signed into law as PL 91-190 on January 1st. President Nixon issued Executive Order 11507, which dealt with pollution caused by Federal facilities; it was formally announced on the 4th of February and six days later was followed by Mr. Nixon's message on the environment. In the latter, the President outlined a comprehensive 37-point program on environmental quality, including 23 major legislative proposals and an additional 14 measures for Executive action. (February was also noteworthy for the Chevron oil spill mentioned earlier.)

President Nixon continued to press for environmental reform with two important actions in March: Executive Order 11514, on the protection and enhancement of environmental quality, and Reorganization Plan No. 2, which established the Office of Management and Budget and a White House Domestic Council.[illegible]

The National Environmental Policy Act (NEPA). On signing the National Environmental Policy Act into law President Nixon stated that "the 1970's absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its waters and our living environment. It is literally now or never."[illegible]

By definition, NEPA is a declaration of national policy to foster productive and enjoyable harmony between man and the environment. Title I of the Act instructs all agencies of the Federal Government to:

- employ an interdisciplinary approach in planning and decision making related to the environment;
- identify and develop methods for insuring the inclusion of environmental values in the decision making process;
- include in all reports and recommendations which might "significantly affect" environmental quality a "detailed statement" on
  - environmental impact of the proposed action
  - unavoidable adverse environmental effects
  - alternatives to the proposed action
  - the relationship between local short-term use of the environment and the maintenance of long-term productivity
  - irreversible commitment of resources if the project were to be implemented;
- study, develop, and describe action alternatives;
- recognize the international and long-range implications of environmental quality;
- develop and use ecological information in planning and development of resource-oriented projects;
- provide assistance to the Council on Environmental Quality."[illegible]

Title II of NEPA established the Council on Environmental Quality (CEQ). Composed of three members appointed by the President (with the advice and consent of the Senate), CEQ formulates and recommends national environmental policies and promotes the overall improvement of environmental quality. Specifically, the Council is to

- assist and advise the President in the preparation of an annual Environmental Quality Report;
- gather information on environmental quality and determine if conditions coincide with NEPA policy;
- review federal programs and activities;
- develop policy recommendations;
- conduct investigations related to environmental quality;
- document and define changes in the natural environment;
- report to the President on the state of the environment;
- comply with Presidential requests for policy studies and recommendations."[illegible]

President Nixon selected Russell Train, then Undersecretary of the Interior as Chairman of CEQ. Gordon J. F. MacDonald and Robert Cahn initially were appointed to serve as the other members of the Council. Since its inception, CEQ has been the subject of controversy—indeed, as has the National Environmental Policy Act.

Some of the criticism leveled against NEPA and the Council on Environmental Quality will be discussed in a later section.

Executive Order 11507. Shortly after NEPA became law, EO 11507 was issued, calling for a three-year program demonstrating Federal leadership in a nation-wide effort to combat pollution. To accomplish this goal, Federal agencies were specifically charged with the responsibility for insuring that government facilities could meet air and water quality standards. In a message to Congress, Mr. Nixon stated that:

> For years, many Federal facilities have themselves been among the worst polluters. The Executive Order . . . not only accepts responsibility for putting a swift end to Federal pollution, but puts teeth into the commitment . . ."[illegible]

Executive Order 11514. Early in March President Nixon issued EO 11514 which continued the theme of Federal leadership on matters related to environmental quality. From the standpoint of environmental policy, the executive order did not appear to differ substantively from NEPA except for broadening the directions given to most Federal agencies. Its primary function seemed to be one of clarifying the role of the newly created Council of Environmental Quality. CEQ "was provided a mandate for reform in the environmental decisions of Federal agencies—from the start of planning to the initiation of . . . projects and programs."[illegible] Specifically, the Council was given authority to:

- recommend priorities for environmental programs;
- determine the need for new policies;
- conduct public hearings;
- promote the use of monitoring systems;
- assist in the achievement of international cooperation;
- issue guidelines and instructions to Federal agencies;
- initiate investigations relating to environmental quality.

It should be noted that EO 11514 also changed the name of the Environmental Quality Council (which had been created by the President in May 1969) to the Cabinet Committee on the Environment, presumably to avoid any confusion with CEQ. The Cabinet Committee was quickly absorbed into the newly established Domestic Council, a White House coordinating group created along with the Office of Management and Budget as part of Reorganization Plan No. 2. Of additional interest here is the fact that the House Committee on Government Operations initially rejected the President's Plan; however, a vote of the full House defeated a resolution to veto the plan and it became effective on July 1, 1970.

Spring 1970

Introduction. Spring, appropriately enough, was an active period in the quest for environmental improvement, both within Government and among the public at large. Senator Muskie's Environmental Quality Improvement Act was finally signed into law as Title II of the Water Quality Improvement Act of 1970. "Earth Day" was observed on April 22nd, and much of its success can be attributed to the efforts of Senator Gaylord Nelson. *Science* called the environmental teach-in on Earth Day "a fresh way of perceiving the environment" but questioned how long the enthusiasm would last.[illegible] Former Secretary of the Interior Hickel recounts a strong difference of opinion within the Administration over participation in Earth Day. Secretaries Hickel and Volpe, both active in SCOPE, were the main proponents, whereas others had expressed misgivings about "anyone getting involved."[illegible]

President Nixon's next action in the environmental field was EO 11523, which established the National Industrial Pollution Control Council. The Ash Committee also submitted its recommendation for the creation of a Department of Natural Resources.

The Environmental Quality Improvement Act. Public Law 91-224 was the product of a compromise worked out by the Muskie and Jackson staffs. The Act does two things: (1) it requires Federal agencies "conducting or supporting public works activities which affect the environment" to implement policies created under current laws; and (2) authorizes an Office of Environmental Quality to be established in the Executive Office.[47] The Office of Environmental Quality was supposed to provide the administrative and professional staff for the Council on Environmental Quality (the Chairman of CEQ was also designated as Director of the Office). In reality, however, the Office of Environmental Quality ". . . has never been formally established as an organizational entity."[48]

Earlier, when NEPA and the Environmental Quality Improvement Act were still in the conceptual stage, the stance taken by Senator Jackson and Congressman Daddario was described as "in part, a power play directed against HEW and Muskie in favor of the Interior Department and a new alignment of congressional committee jurisdictions."[49] In Steinhart's opinion, the requirement in P.L. 91-224 that annual Environmental Quality Reports "be transmitted to each standing committee of the Congress having jurisdiction over any part of the subject matter . . ." was Muskie's way of maintaining his jurisdictional prerogatives.[50]

Ash Council Report. On the 12th of May, the President's Advisory Council on Executive Organization submitted a formal memorandum calling for a consolidated Department of Natural Resources (DNR). In so doing the Council cited the need for a coordinated natural resource policy which, theretofore, had been "virtually impossible to achieve."[51] The memorandum went on to say that, by creating a clearly defined center of responsibility, the Federal Government's relationships with state and local government and private industry would be simplified considerably. In essence, the proposed Department of Natural Resources was to have consisted of the following areas: land and recreation, water resources, energy and mineral resources, marine resources and technology, and geophysical science services.

The Ash Council recommendations concerning a DNR have not been implemented for a variety of reasons, including lack of Congressional action on reorganization. (It should be noted, however, that the DNR proposal was reintroduced by the White House in June 1973.) Perhaps of greater significance to the present discussion is the position taken by the Council with respect to key elements of the President's Reorganization Plans 3 and 4 which quickly followed.

Summer 1970

Introduction. In July 1970 President Nixon announced Reorganization Plans No. 3 and 4. The former established the Environmental Protection Agency; the latter created the National Oceanic and Atmospheric Administration. Although both Plans were eventually approved by Congress, each was opposed by a coalition of concerned lawmakers, Administration officials, and conservation groups—but for altogether different reasons.

Reorganization Plan No. 3. With the backing of the Ash Council, President Nixon submitted a plan to Congress creating an independent Environmental Protection Agency (EPA). The Chief Executive indicated that the Federal Government must regard the environment "as a single, interrelated system" and, consistent with that perception, there is a need to reorganize pollution control programs under one umbrella.[52] Mr. Nixon cited previous failures to coordinate agency efforts, partly because the traditional way of viewing pollution had been "along media lines" (e.g., water, air, etc.) rather than acknowledging that pollution frequently cuts across all media. EPA's method of attacking pollution problems would involve:

- identifying pollutants;
- tracing their path through the environmental chain while observing

and recording any changes in form;

- assessing the effects on human health and welfare of exposure to pollutants;
- keeping a watchful eye for synergistic effects among pollutants;
- locating an optimum point in the ecological chain for "interdiction."[53]

The programs transferred from other agencies to form EPA were the Federal Water Quality Administration, the National Air Pollution Control Administration, the Bureau of Water Hygiene, the Bureau of Solid Waste Management, the Bureau of Radiological Health, Pesticides Standards and Research, Pesticides Registration, Federal Radiation Council, and Studies of Ecological Systems. With respect to the roles of the Council on Environmental Quality and the Environmental Protection Agency, Mr. Nixon stated that

> . . . the Council focuses on what our broad policies in the environmental field should be; the EPA would focus on setting and enforcing pollution control standards. The two are not competing, but complementary. . . .[54]

In November, William Ruckelshaus was appointed Administrator of EPA which became operational the following month.

EPA advocates and opponents

In the opening remarks to this subsection it was noted that Roy Ash was a staunch advocate of an Environmental Protection Agency. The President's Advisory Council on Executive Organization went on record in memoranda dated April 29 and May 12 supporting the idea "that key antipollution programs be merged in a new and independent Environmental Protection Administration to give priority to the task of cleaning up our environment."[55] Senator Muskie also seemed committed—at least in principle—to an "EPA" concept. In the Introduction to Davies' book, Senator Muskie argued that:

> One of our most urgent needs is the creation of an independent watchdog agency, uninvolved with the operating programs of the government and dedicated solely to the protection and enhancement of environmental quality. We cannot afford to vest the duty to enforce environmental standards in the very agencies involved in the development of those resources for public use.[56]

Within the Nixon Administration, one of the most vocal opponents of EPA was Secretary Hickel:

> . . . I strongly urged, and repeatedly fought for the transforming of Interior into a Department of Natural Resources and the Environment. I reasoned that it was self-defeating to separate resource development from environmental protection. . . . The President chose another course. . . . This decision . . . (to create EPA) removed from the Interior the Federal Water Qualit dministration as well as several c r offices dealing with pollution control. I still believe that the environment suffers when the policing function is isolated. . . .[57]

Congressional opposition to EPA, while generally muted, was based on two points: (1) appropriate Congressional committees had not been consulted about the contents of Reorganization Plan 3, and (2) a small, but critical group of environmental programs (e.g., HUD's water and sewer grant program, DOT's noise pollution program, etc.) were omitted. Despite the criticism the Plan became effective in October.[58]

Reorganization Plan No. 4. The plan to create a National Oceanic and Atmospheric Administration (NOAA) can be traced directly to the Commission on Marine Science, Engineering and Resources—sometimes referred to as the Stratton Commission—although its roots go back much farther than that. Edward Wenk provides a fascinating account of early interest in a "superagency" for the marine sciences in his

Politics of the Ocean. It is apparent from Wenk's book that there were strong odds against such an agency being established, particularly given a downward spiral of interest coupled with powerful opposition at the highest levels of government.

In a prepared statement accompanying Reorganization Plan 4, Mr. Nixon said that, by bringing together a select group of departments then scattered throughout the Federal Government, a unified, coordinated program could be initiated which would effectively cope with "the compelling need for protection from natural hazards and the need to develop marine resources." As spelled out in the Plan, NOAA would consist of the following programs:

- Environmental Science Services Administration;
- selected activities of the Bureau of Commercial Fisheries;
- marine sport fish program of the Bureau of Sport Fisheries and Wildlife;
- Office of the Sea Grant Programs;
- elements of the United States Lake Survey;
- National Oceanographic Data Center;
- National Oceanographic Instrumentation Center;
- National Data Buoy project.

As *Science* points out, other than Edward Wenk (who, in 1970, was the executive director of a White House advisory council on marine affairs), one of the few influential proponents of NOAA was then Attorney General John Mitchell. Wenk credits Mitchell with overcoming considerable opposition from key Presidential advisors, among them Roy Ash. The President's Advisory Council on Executive Reorganization had strongly recommended against NOAA as early as January. In the Council's May memorandum, Ash stated that:

> We wish to reaffirm our recommendation that an independent NOAA should not be established. To create such a separate agency would be inconsistent with the basic objective or our proposal for a new Department of Natural Resources. It would separate closely related natural resource functions at the very time when it is urgent to bring them together . . .

Ash had suggested an alternative plan, supported by Secretary Hickel, which would have involved consolidating a number of marine-related programs under the aegis of the Interior Department. Eventually, NOAA was established within the Department of Commerce despite opposition from many conservation groups. Their argument was "that traditionally the Department of Commerce had represented the industrial and economic viewpoint, rather than the public use and enjoyment of a natural resource." Congress nevertheless approved the plan, and NOAA became a reality with Dr. Robert White at the helm.

Epilogue: the struggle continues

The decision to restrict this discussion of environmental policy-making to a two-year period was, of course, arbitrary. Obviously, the struggle for leadership in environmental affairs continued. For example, one of the last and most important products of the 91st Congress was the Clean Air Amendments of 1970, which strengthened controls over automobile emissions and hazardous substances emitted from new and existing sources. These Amendments embody Congressional recommendations as well as those contained in the President's 1970 Message on the Environment. According to the *National Journal*, ". . . it appeared that the President had effectively challenged Muskie's pre-eminence in environmental matters, . . ."

Two years later, as the present paper is being written, little has changed. The 92nd Congress overrode the President's veto on the Federal Water Pollution Control Amendments—the most expensive environmental bill in history. The bill's price tag is $24.7 billion, to be spent over a three-year period at a time when inflation and deficit spending are key political issues. Dedicated environmentalists were not alarmed by the cost, but were concerned that "the measure is an authorization, not an appropriations bill, and there is a feeling that considerably less money will actually be expended than is called for in the legislation."[26] In late November 1972 President Nixon impounded more than half the funds which Congress had set aside for new water treatment plants, although this action has been submitted for judicial review.

Three significant features of the Water Pollution Control Act especially deserve attention: (1) effluent limitations, not water quality standards, are now the enforcement mechanism of the water pollution control programs; (2) private citizens have the right to go to court on environmental issues, even to sue violators of the new law—however, plaintiffs must demonstrate that the violation has adversely affected their interests; and (3) the water discharge permit program has been tightened, giving EPA regulatory powers over pollutant discharge into coastal and inland waters.

Just before adjournment the 92nd Congress enacted some additional measures worth noting.[27] Foremost among these is the Environmental Pesticide Control Act, which makes EPA the chief regulatory agency in the pesticide field and also simplifies the procedure for removing dangerous products from the market. Federal authority had previously been based on the Insecticide, Fungicide, and Rodenticide Act of 1947 which contained little, if any, regulatory power. The 92nd Congress was also responsible for such important environmental measures as the coastal zone management bill, a law to control dumping in oceans and coastal waters, and a noise control act.

NEPA: pro and con

At this point it seems appropriate to take a closer look at the National Environmental Policy Act, this time from the vantage point of recent history. Three years have elapsed now since NEPA was signed into law, a sufficient period to evaluate its accomplishments and failures.

In a recent presentation before the Interprofessional Council on Environmental Design, Fred Anderson, Executive Director of the Environmental Law Institute, suggested five areas where NEPA has been successful:

- The National Environmental Policy Act has induced the Federal Government to give greater attention to public concern about "quality of life";
- the NEPA requirement of environmental impact statements ("102 process") has provided a systematic way of cutting across Government lines, necessitating the creation of intergovernmental coordinating groups and task forces;
- the 102 process has engendered active public participation in policy making and, in general, has increased the level of public awareness with respect to government programs which might affect the environment;
- Federal agencies have had to supplement their staffs with better in-house talent—interdisciplinarians with a fresh point of view;
- the language of NEPA has been vigorously enforced by the courts (NEPA is no "paper tiger").[28]

Ironically, Section 102(2)(C), which spells out the requirement for environmental impact statements, has probably evoked more controversy than any other aspect of NEPA, yet it appears to have been an afterthought. The *legislators* who drafted NEPA contemplated two- or three-page impact statements, not verbose documents, but the latter have frequently been produced.[29] Professor Harold P. Green, Director of George Washington University's Law, Science and Technology Program, told members of the American Association for the Advancement of Science that "It is difficult to believe NEPA isn't going to get its teeth pulled." He went on to say that if the legal implications of the Act had been anticipated, it never would have been enacted."[70] Even NEPA's chief advocate in the House of Representatives, Congressman Dingell, recently remarked: "I have some doubts that NEPA would pass in its present form today. I very much doubt if the Section 102 provision . . . would be in . . ."[71] The pessimism of both men stems from the fact that successive court rulings have greatly expanded the concept of "environmental consequences:" almost any federal government activity might conceivably require impact statements. As Green points out, agencies have been inundated with "immense amounts of paperwork."[72]

Attacks from both sides

NEPA has been attacked both for "not doing enough" and for "going too far." The position of those in the first camp has been stated as follows:

> . . . While federal courts have ruled in almost 200 cases that the government has failed to comply with NEPA or other environmental protection laws, the courts have not stopped a single project on substantive grounds. The merit or lack of merit of a project has not been the basis of any environmental court decision. Some environmental lawyers believe a court may one day rule on the substance of a proposed project, that a court may find, for instance, that a project is too environmentally destructive or is not the best alternative. So far, however, the courts have avoided the substance of these conflicts.[73]

In essence, the courts have focused on procedural requirements, leaving open the possibility of having a beautifully written set of impact statements for a pointless or potentially destructive project. Some additional problems include (1) the fact that environmentalists have no recourse except going to court, (2) the absence of any requirement for comments on *final* impact statements—only on draft statements, (3) the absence of any mechanism for assessing the validity of impact statements (i.e., to determine how the information was obtained), and (4) the exclusion of the private sector from the impact statement process.

Similar comments were attributed to two departing presidential advisors, Robert Cahn and Gordon MacDonald who, with Russell Train, comprised the original Council on Environmental Quality. Cahn thought that the courts had done an excellent job of "getting environmental concerns built into decision making"; however, he felt there was still considerable room for improvement on the part of some federal agencies:

> We're getting much better compliance with the letter of the law but I'm not satisfied with compliance with the spirit of the law.
>
> That is, I'm not satisfied that the agencies in all cases have really considered the environmental impact, instead of making their decision first and then writing an environmental impact statement to justify it. This is still done too much.[74]

MacDonald stated that one of CEQ's shortcomings might have been the inability to devote sufficient staff time for thorough review of environmental impact statements. Nevertheless, he and Cahn both thought that the Council had accomplished a great deal in the review process and had developed important roles in the drafting of legislation, providing advice to the President, and coordinating the activities of other Federal agencies.

It is probably correct to say that there are just as many critics who would like to see NEPA rescinded (or, at the very least, weakened) as there are individuals advocating tougher environmental measures. Marvin Zeldin, a frequent contributor to *Audubon*, is particularly apprehensive about future legislation designed to bypass NEPA or to abolish citizen lawsuits. According to Zeldin, the National Environmental Policy Act has been referred to as a "trumpet call to retreat into the past," and its adherents have been accused of "blocking progress" and "promoting mischief."[35] Even many moderates, who quickly agree that NEPA has had a positive effect on the nation's ability to maintain and improve the environment, argue that some change in NEPA is inevitable. In their opinion, continued costly delays and the denial of services to people may well swing the pendulum away from environmental concerns.

A recent EPA publication provides several examples of projects which were modified or canceled as a direct result of NEPA.

- In March, 1972, the Army Corps of Engineers prepared draft impact statements covering proposed construction of a 1760-foot pier extending from Assateague Island into the Atlantic. The project was terminated when negative comments underscored the likelihood that natural barriers along the eastern coastline would be harmed.
- A dredging operation designed to "improve safety for barge crossings" in Florida's Gulf Intracoastal Waterway was halted because of harm to the "natural habitat" of aquatic life in the area.
- In a landmark decision, Calvert Cliffs Coordinating Committee v. AEC, the Court instructed the Atomic Energy Commission to (a) devote greater attention to the environment in its internal review process, (b) consider halting nuclear generating plant construction until environmental factors are carefully weighed, and (c) make its own assessment of water quality rather than rely on Federal or State certification."[36]

Whither the environmental cause?

But what of the environmental movement itself? Is it likely to continue and, if it does, what direction will it take? At the close of 1972, environmentalism seemed to be making progress on some fronts while losing ground on others. On the plus side one can cite the following:

1. Court victories resulting from citizen lawsuits continue to be a source of optimism. In addition to those cases previously described, environmentalists have achieved court victories primarily because judges were willing to set bonds at reasonable levels; otherwise, the expense would have precluded groups such as the Sierra Club and Friends of the Earth from obtaining judicial review. Indications are that future court decisions may be based on factors previously ignored in NEPA, for example, clear evidence that alternatives to the proposed action and social impact have been considered.

2. There are signs that the environment is becoming a political issue at the grass-roots level. Scammon and Wattenberg predicted in April 1971 that ecology would be important in local elections; the 1972 elections appear to support their forecasts.[37] For example, the League of Conservation Voters was heavily involved in a number of congressional and gubernational races, backing candidates with contributions as well as endorsements. Spokesmen for the League attributed the primary defeat of Representative Aspinall, and the unseating of Senator Gordon Allott to Colorado environmentalists.[38] Colorado voters also vetoed Denver as a site for the 1976 Winter Olympics, partly due to the threat of environmental degradation. However, perhaps the biggest victory was scored in California, where, in the face of bitter opposition from petroleum and other industrial interests, voters approved a proposition calling for strict coastal zoning and careful regulation of future coastal development.

3. Despite enormous difficulties, the 1972 United Nations Conference on the Human Environment appeared to open the door to international cooperation on environmental problems. Agreement was reached on 109 separate recommendations, incorporated in a declaration on the environment, a global

action plan, and the machinery to carry it out."[79]

On the debit side of the ledger, the staggering cost of cleaning up the environment will undoubtedly become a highly polarized issue. The Council on Environmental Quality estimates that approximately $287 billion will have to be spent during the current decade in order to do the job properly.[80] Thus far, solid data are lacking on public willingness to underwrite environmental programs. Presumably, many people overlook the fact that someone has to pay for a cleaner environment—namely, the taxpayer.

And now, the energy crisis . . .

Another area of concern to environmentalists is the energy crisis. Whether or not a "crisis" exists, and who should be held responsible, remains the subject of heated debate. Part of the problem rests with the move to low sulfur coal and oil which has taken a substantial fraction of fossil fuel out of the pool. Furthermore, it has been suggested that the environmental movement is to blame for delaying nuclear power plants and for "hindering the construction of new petroleum refineries."[81] During the first few weeks of 1973, when schools and businesses were forced to shut down because of fuel shortages, the petroleum industry launched a vigorous advertising campaign calling for increased incentives for oil exploration, fewer restrictions on offshore drilling, and postponement of deadlines for achieving air and water quality standards. Secretary of Agriculture Butz, upon assuming his new role as the President's natural resource counselor, said that:

> We should have been thinking about the energy shortage when construction of the Alaskan pipeline was blocked 5 years ago. . . . When we run short of power, the first people to have their power shut off should be those who blocked the Alaskan pipeline.[82]

At the same time, the oil industry has received criticism from CEQ Chairman Russell Train who points out that the recent "spate of advertising" blaming environmentalists for gasoline shortages neglects to mention the extent to which oil companies miscalculated fuel oil and gasoline needs.[83] The Federal Government has also been criticized for not lifting quotas on foreign oil imports and for failing to develop "a coordinated, coherent national energy policy geared to the public interest."[84] Secretary of Commerce Peterson, commenting on the energy-ecology debate, has argued that both sides are going to have to accept trade-offs:

> If we can forge a national commitment and if, on that foundation, we can construct national environmental policies, national energy policies, and national economic growth policies that are coherent and reconciled, one with the other, we may well be able to solve our energy problem. With such a commitment, we may well be able to clean up our environment without slowing economic growth.[85]

Decline of the eco-fad?

Is environmentalism an "elitist fad" as some critics have charged? Has the American public's concern about environmental quality diminished, or was it, in fact, exaggerated from the beginning? The answer in both cases is a qualified "No", based on the results of recent attitude and opinion surveys:

1. Cantril and Roll found that, in contrast to the results of previous national surveys conducted in 1959 and 1964, pollution "emerged distinctly" as a new national concern in 1971.[86] Nevertheless, fear about pollution still ranked well below apprehension about war, national disunity, economic instability, communism, and lack of law and order.

2. Watts and Free updated the Cantril and Roll study in 1972 with a national probability sample of 1806 respondents.[87] Their findings indicated that the environment was unquestionably a major concern of the American

public; however, they also found evidence that a vigorous environmental "backlash" had developed within government, industry, and the scientific community. Support for environmental reform appeared uniform across all population strata, with greatest concern expressed by the young, the well-educated, suburbanites, professional and business groups, Westerners, Catholics, political independents, and liberals; less concern was noted among those with little education, little income, and those who reside in rural areas:

> Looking . . . at the entire range of environmental issues, it would appear that the public . . . would not only condone, but indeed welcome, a considerable new investment in solving the problems of air and water pollution and solid waste disposal. The people remain leery, however, about more sweeping and revolutionary attacks on environmental problems, if these approaches assume overtones of governmental control through such devices as officially limiting economic or technical growth or inhibiting an increase in population."

3. Tognacci and his associates interviewed 141 randomly selected subjects in Boulder, Colorado. Their results were similar to those reported by Watts and Free (persons expressing the most concern about environmental quality were generally younger, better educated, more liberal, and higher in socioeconomic status), they arrived at a considerably more pessimistic conclusion:

> Taken together, our findings suggest that the ability of the ecology movement for unifying a diverse constituency has perhaps been overrated. At least at this point in time, those persons most con-concerned about environmental issues appear to reflect the same configuration of social and psychological attributes which have traditionally characterized individuals active in civic, service, and political organizations . . . Recent increments in public concern about ecology may merely reflect a more intense commitment by this relatively select group of people rather than broad increases in sensitivity to environmental problems among the general citizenry."

Tognacci's findings underscore one additional problem which is both national and international in character: the age-old battle between "haves" and "have nots." The U.N. Conference on the Human Environment indicated all too clearly that the developing nations perceive environmental concern as the "rich man's dilemma." Worse, some countries consider it an "imperialist plot" to prevent poorer countries from reaching full potential. In sum, unless environmental issues can be shown to apply to a broad spectrum of the American public, and to transcend national boundaries, the future of environmentalism may be in jeopardy.

Notes for Paper 1

[1] Lloyd Free and Hadley Contrill, *The Political Beliefs of Americans* (New York: Simon and Schuster, 1968), pp. 94-112.

[2] James Ridgeway, *The Politics of Ecology* (New York: E. P. Dutton & Co., Inc., 1971) pp. 118-119.

[3] The Committee of Scientists, "The Torrey Canyon—Report of the Committee of Sceintists on the Scientific and Technological Aspects of the Torrey Canyon Disaster," available from Her Majesty's Stationery Office, (1967), 48 pp.

[4] Julian McCaull, "The Black Tide," *Our World in Peril: An Environmental Review*. Sheldon Novick and Dorothy Cottrell, eds. (Greenwich, Conn.: Fawcett Publications, Inc., 1971), p. 87.

[5] Walter J. Hickel, *Who Owns America?* (New York: Prentice Hall, Inc., 1971), p. 87.

[6] *Ibid*, p. 91.

[7] *Ibid*, p. 105.

[8] Cecile Trop and Leslie Roos, "Public Opinion and the Environment," *The Politics of Ecosuicide*. Leslie Roos, ed. (New York: Holt, Rinehart, & Winston, Inc., 1971), p. 54.

[9] Free and Cantril, *The Political Beliefs of Americans*, p. 105.

[10] Trop and Roos, "Public Opinion and the Environment," pp. 55-56.

[11] J. Clarence Davies, *The Politics of Pollution* (New York: Pegasus, 1970), pp. 78-82.

[12] Trop and Roos, "Public Opinion and the Environment," p. 60.

[13] *Ibid*, p. 62.

[14] Frank Egler, "Pesticides—in Our Ecosystem," *The Subversive Science*. Paul Shepard and Daniel McKinley, eds. (Boston: Houghton Mifflin Co., 1969), p. 251.

[15] *Ibid*, p.250-251.

[16] Philip Converse, Aage Clausen, and Warren Miller, "Electoral Myth and Reality: the 1964 Election," *American Political Science Review*, 49, (1965), pp. 321-336.

[17] John Maloney and Lynn Slovonsky, "The Pollution Issue: A Survey of Editorial Judgments," *The Politics of Ecosuicide*. Leslie Roos, ed. (New York: Holt, Rinehart, & Winston, Inc., 1971), pp. 64-78.

[18] Max Gunther, "Where Does Television Stand on Ecology," *TV Guide*, August 4, 1972, p. 7.

[19] Joseph Klapper, "The Social Effects of Mass Communication," *The Science of Human Communication*. Wilbur Schramm, ed. (New York: Basic Books, Inc., 1963) pp. 65-76.

[20] "Issue of the Year: The Environment," *Time*, January 4, 1971.

[21] Trop and Roos, "Public Opinion and the Environment," p. 57.

[22] Richard Scammon and Ben Wattenberg, *The Real Majority* (New York: Berkeley Publishing Corporation, 1970), p. 299.

[23] Davies, *The Politics of Pollution*, p. 17.

[24] John Steinhart, "The Making of Environmental Policy: The First Two Years," *Environmental Impact Analysis: Philosophy and Methods*. Robert Ditton and Thomas Goodale, eds. (Madison, Wisconsin: University of Wisconsin Sea Grant Program, 1972), pp. 5-21.

[25] Michael Barone, Grant Ujifusa, and Douglas Matthews, *The Almanac of American Politics* (Boston: Gambit, Inc., 1972), p. viii.

[26] Davies, *The Politics of Pollution*, p. 70.

[27] Barone, Ujifusa, and Matthews, *The Almanac of American Politics*, p. 895.

[28] Davies, *The Politics of Pollution*, pp. 70-71.

[29] *Ibid*, p. 71.

[30] *Ibid*, p. 71.

[31] Steinhart, "The Making of Environmental Policy: The First Two Years," p. 7.

[32] Elizabeth Boswell, *Federal Programs Related to Environment*, (Washington, D.C.: Library of Congress, 1970), p. 7-8.

[33] Steinhart, "The Making of Environmental Policy: The First Two Years," p. 13.

[34] Davies, *The Politics of Pollution*, pp. 71-72.

[35] *Ibid*, p. 72.

[36] Boswell, *Federal Programs Related to Environment*, p. 1.

[37] *Ibid*, pp. 1-2.

[38] Hickel, *Who Owns America?*, p. 213.

[39] Susan Abbasi, *Federal Environmental Activities*, (Washington, D.C.: Library of Congress, 1972), p. 5.

[40] Carolyn Harris, *In Productive Harmony* (Washington, D.C.: Environmental Protection Agency, 1972), p. 1.

[41] Council on Environmental Quality, *Environmental Quality: The First Annual Report of the Council on Environmental Quality*, (Washington, D.C.: U.S. Government Printing Office, 1970), pp. 243-246.

[42] *Ibid*, pp. 243-249.

[43] Elizabeth Boswell, *Executive Reorganization for Environmental Affairs* (Washington, D.C.: Library of Congress, 1971, p. 5.

[44] *Ibid*, p. 7.

[45] *Science*, May 1, 1970, p. 558.

[46] Hickel, *Who Owns America?*, p. 220.

[47] Boswell, *Executive Reorganization for Environmental Affairs*, p. 8.

[48] Abbasi, *Federal Environmental Activities*, p. 2.

[49] Davies, *The Politics of Pollution*, p. 72.

[50] Steinhart, "The Making of Environmental Policy: The First Two Years," p. 16-17.

[51] The President's Advisory Council on Executive Organization, *Memorandum for the President: The Establishment of a Department of Natural Resources* (Washington, D.C.: Executive Office of the President, May 12, 1970), p. 5.

[52] Boswell, *Executive Reorganization for Environmental Affairs*, p. 13.

[53] *Ibid*.

[54] *Ibid*, p. 15.

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III.2 The positive role of environmental management

Lynton K. Caldwell *

The year 1970 marked the beginning of environmental management as a distinct and identified function of government in the United States. On January 1, 1970, President Nixon signed into law the National Environmental Policy Act; and, on July 9, sent to Congress Reorganization Plan No. 3 of 1970 creating the Environmental Protection Agency. The National Environmental Policy Act made explicit the responsibility of the Federal government for the quality of the national environment. It did this in language, and with institutional arrangements and procedures, that made its declaration of policy operational. The Environmental Protection Agency consolidated ten Federal pollution control programs into a single organization based upon the perception of the environment "as a single interrelated system".

In defining the roles and relationships of these two innovations in environmental management, the President declared that the Council on Environmental Quality, created by NEPA, ". . . focuses on what our broad policies in the environmental field should be; the EPA would focus on setting and enforcing pollution control standards." Both measures, the NEPA and the EPA, were outcomes of a public awareness and concern for the state of the human environment that, during the 1960's, grew with a speed and scope utterly unexpected by most of the nation's leadership in public, economic, and academic affairs. It should not be surprising, therefore, that some measure of uncertainty and confusion has characterized the practical application of environmental policy and law.

This confusion over the nature of the environmental management task may be traced, in part, to the persistence of traditional ways of thinking about the functions of government and about man's relationship to his surroundings. To a large number of Americans and their public representatives, environmental policy meant pollution control. Rachel Carson's *Silent Spring*, published in 1962, may be described as the *Uncle Tom's Cabin* of the environmental protection movement. It was an attack upon pollution through pesticides, and it reinforced efforts of longer standing to obtain effective action to cleanse the nation's air and water.

Pollution control is nothing new

The remedies for pollution largely fell within the traditional scope of American government. They were the conventional processes of regulation and prohibition, with historical roots in the public health movement. Although anti-pollution legislation affected economic practices and assumptions, it was generally consistent with traditional relationships between government and the enterprise economy. This interpretation of environmental policy implied an essentially policing role for public officials—it was the negative role of environmental management. Its intended outcomes were foreseen as "positive", in the sense that an improved quality of the environment was the anticipated result.

From the viewpoint of the so-called polluter (public or private), the effect of environmental protection legislation was largely of an economic burden. In some cases, changes in technology and production methods were required to satisfy new standards of environmental amenity. But only in relatively few instances did environmental policy appear to require a radical change in the relationship between the public and private sectors of American society or among the several levels of government. Nevertheless some observers, chiefly unfriendly, of the environmental quality movement saw it as inherently threatening to the enterprise economy and to customary personal freedoms. Characteristically, these critics were from the far "right" of the political spectrum. The curious coincidence of the celebration of Earth Day in 1970 with the centenary of the birth of Lenin convinced the suspicious that "environmentalism" was indeed a cover for creeping Marxism. But conversely, the extreme left saw environmental quality as a diversionist burgeois tactic to distract public attention from more urgent issues of war, racism, poverty, and injustice.

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*Presented by Lynton K. Caldwell, Arthur F. Bentley Professor of Political Science and Professor of Public and Environmental Affairs, Indiana University, at the National Conference on Managing the Environment.

The environmental movement was thus variously interpreted by its friends and its opponents, and most interpretations were oversimplifications of the actual state of affairs. Nevertheless, the environmental issue had been clearly and dramatically stated for the American people. But, as so often happens in public affairs, the symbolism of political rhetoric was accepted as a substitute for action. In addressing the Congress on February 8, 1965, President Lyndon B. Johnson spoke with force and eloquence of the threats to the quality of life posed by the darker side of modern technology, by uncontrolled waste, by urban sprawl and blight, and by the misuse of the nation's natural assets. He then spoke of the "new conservation" in language that defines both the negative and positive roles of environmental management.

He said that:

> To deal with these new problems will require a new conservation. We must not only protect the countryside and save it from destruction, we must restore what has been destroyed and salvage the beauty and charm of our cities. Our conservation must be not just the classic conservation of protection and development, but a creative conservation of restoration and innovation. Its concern is not with nature alone, but with the total relation between man and the world around him. Its object is not just man's welfare, but the dignity of man's spirit.

Words without action

But neither President Johnson nor the Congress was prepared to act upon this noble statement. To have acted would have required a commitment of money and manpower that the nation was not prepared to make. More importantly, it would have required a readiness to consider fundamental changes in laws and attitudes toward the ownership and use of property, toward economic development, and toward the functions and jurisdictional relationships of governmental agencies. President Johnson's Address ran well ahead of his own intentions. And it is still ahead of ours—if the present policies and programs of the Federal government represent the true readiness of the American people to turn seriously to the positive task of shaping their environmental future.

This reluctance of the Americans and their public representatives to effectively confront the environmental issue does not imply a disregard of significant accomplishments at all levels of government. But most of this has been negative accomplishment in the sense that measures have been taken to retard environmental deterioration—to keep conditions from becoming worse. We have saved some wilderness from the chain saw, some scenic rivers from dams and draglines. We have a few positive victories, such as the restoration of Lake Washington and the renewal of all too small fractions of some of our cities. Yet these are radly more than tokens, even though they may be significant and valuable tokens, of the true dimensions of the positive role of environmental management.

The states generally have been slow to accept responsibility for environmental quality beyond the mandates of Federal law. Yet some of them have gone far beyond Federal action in innovative legislation and administration. States as different as California, Hawaii, and Vermont have addressed certain of their particular environmental problems with a boldness lacking in most States.

The cities have been severely constrained in coping with their major environmental problems. Their present circumstances, with few exceptions, are profoundly discouraging. To ". . . restore what has been destroyed and salvage the beauty and charm of our cities . . ." will require solutions to social and political problems that we have not yet realistically faced, and will require the marshalling of money and talent on a scale only obtainable heretofore under the duress of war. Ultimately, we will make the necessary effort, not because we want to, but because we must. How soon we will confront necessity cannot be foreseen. We will not do so until the bankruptcy of our present approaches toward coping with our socioecological problems becomes unmistakably evident.

The ultimate limits

Historically, public realization that its institutions and leadership have failed to meet the challenge of its problems has often led to disastrous consequences. Unfortunately, the tempo and complexity of modern society could result in sudden and drastic events that could lead to a collapse of public confidence and result in *ad hoc* and expedient panaceas. Bad conditions could be made worse. Recognition of this danger has stimulated a variety of efforts and proposals to anticipate future consequences of present trends. The growth of "futurology", the call for a naticnal Council of Urgent Studies, and the Club of Rome's inquiry into the predicament of mankind are evidence of this apprehension. In all of these conjectural approaches to the future, the relationship between man and his environment—natural and artificial—is a major factor. The full scope of what John Platt describes as a coming crisis of crises extends beyond the limits of our immediate concern. But we may consider one positive step that could be taken now to prepare us to act purposefully and constructively when we face the opportunity and necessity for taking in hand the shaping of our environmental future.

The action that I propose is the logical and necessary step to implement Lyndon Johnson's ". . . creative conservation of restoration and innovation," and to realize the objectives set forth in the National Environmental Policy Act and endorsed in principle by President Nixon and the Council on Environmental Quality and by prominent members of both major parties in the Congress. As one step toward more firmly grasping control over the conditions of our national existence, I propose establishment by the Congress of the Environmental Reconstruction Agency.

Environmental reconstruction

Consideration of the functions and structure of this agency should begin now, even though in advance of a willingness of the Congress and the President to establish it by law. The organization of the Agency should be thought through, and its tasks and costs analyzed while there is time for rational consideration of options and alternatives. Our traditional American way is to meet foreseeable, but unforeseen, emergencies with improvised responses, with "crash" programs, and frequent miscarriage of hopes and opportunities. There are risks in the planning that this proposal implies, but are these risks greater than those of *ad hoc* responses by an unprepared government and people under stress?

The E.R.A. would neither supersede nor resemble the EPA. Its most effective form of organization would be one of the problems to be worked out. But it seems very unlikely that it would be a consolidated bureaucratic structure. More likely it would be a coherent system or network for marshalling and deploying resources of knowledge, manpower, and money and, most importantly, for assisting people throughout the country to identify and analyze their environmental options within the full range of human values. It would provide a capability for focusing national attention on large and critical environmental problem areas that have thus far remained beyond the reach of our public institutions. Among the more apparent of these areas are the Southern Appalachians, the Great Lakes, impoverished areas of the arid Southwest and, above all, the tragic wasteland areas of urban America.

Among the specific tasks toward which the machinery of the E.R.A. would be directed would be the restoration of derelict land and degraded landscapes, the renewal and rebuilding of deteriorated urban and suburban areas, the removal of misplaced and decayed structures across the countryside, and the selective and democratically-controlled regrouping of smaller settlements to form communities of political, economic, and cultural viability.

The means of action might include a revival of the former Civilian Conservation Corps' *idea* as an Environmental Conservation Corps, but open to both sexes and to part-time as well as full-time service. The conventional instruments of loans, contracts, grants, technical services, and pilot projects would almost certainly be utilized.

A major resource would be the Corps of Engineers. The tasks of environmental reconstruction offer the kind of challenge for which the capabilities of the Corps are especially well-adapted. The Corps of Engineers is much too valuable a national asset to waste on the kind of economically specious and environmentally damaging public works that the Congress has too often thrust upon it. There is no obvious answer to how the Corps might most effectively be related to the E.R.A. It would not necessarily have to become an integral part of it to perform its technical and managerial functions in accordance with a comprehensive plan coordinated through the E.R.A.

Similarly the Bureau of Reclamation, now overdue for liquidation, might provide valuable scientific and technical resources for the new agency.

A new 'Manhattan project'

In 1968, at a *Symposium on Human Ecology* sponsored by the Public Health Service I stated that: "Although Americans may not be prepared to make the effort, a 'Manhattan Project' for human ecology is as greatly needed now as any military preparation ever was." I believe today that the magnitude and the importance of the task of environmental reconstruction is of the same order of priority as national security and is, in a very real sense, a function of national security. The "Manhattan Project" suggests the magnitude and focus of the reconstruction effort, but not its structure nor its method of operation.

What order of funding would an Environmental Reconstruction Agency require to implement the positive role of environmental management? During its initial operative stage, but beyond its formative period an annual budget of $10 billion might be sufficient, provided that it was administered in such a way as to generate an additional $10 to $15 billion from state, local, and nongovernmental sources. Not all E.R.A. funds would necessarily need to come from new Federal revenues. Transfers from existing programs of diminishing priority could account for a significant portion of the total.

Here then is a positive approach to the role of environmental management. To make the effort effective, a national land-use planning act would be an essential concomitant. Land-use planning legislation is now before the Congress, and enactment of an adequate bill could be a significant step toward giving the American people a means essential to the shaping of their future environments. How will our future be shaped? By accident, inadvertence, unidimensional policies, and *ad hoc* expediency; or will we risk the human errors inherent in rational planning and foresight and make the hard choices of responsible stewardship for our future? These are the polarities of our choices.

III.3 State governments tackle pollution

Elizabeth H. Haskell *

The explosion of interest in the environment which began in the late Sixties is bringing wide-ranging reform to the environmental institutions of state government. A number of states have taken initiatives and are beginning to carve out a new strategic place for themselves in environmental protection. States are closer to many pollution and natural resource problems than is the federal government and so are able to structure their attack in a more tailor-made fashion. With this more detailed perspective, states are moving to take over some actual planning, construction, and management tasks. In the process of assuming more control over land use and treatment of wastes, some traditionally local environmental functions are now shifting in part to the states.

While the federal government is moving toward national pollution control standards, the new consolidated state environmental agencies, with their increased emphasis on pollution regulation, may have a stronger role in the daily implementation of standards, through permit processes, surveillance, and enforcement actions. This subtle shift of roles among federal, state, and local governments may be molding a new partnership for public action to protect the environment.

As states have sought to assume new environmental responsibilities, they have often sought to make their governmental organizations match problems and ensure that each has adequate legal authority. To do so, some states have created new government agencies to administer new state programs. Others have reorganized existing executive agencies or assigned a new role to the judicial institutions of government.

Consolidated departments

Illinois, Minnesota, Washington, Wisconsin, and New York provide variations on the theme of state program reorganization, designed to achieve a comprehensive approach to environmental problems. Other states, such as Vermont, New Jersey, Delaware, Pennsylvania, Arkansas, Oregon, Massachusetts, and California also have set up such new environmental departments, and still others are considering such action.

Pollution control is the main focus of the new environmental agencies—all except Wisconsin where traditional conservation programs predominate—with a functional emphasis on regulatory work. It was hoped that pulling together common responsibilities for standards-setting, permits, monitoring, and enforcement in one agency would reinforce control strategies and make them stronger and more systematic, avoiding conflicting requirements for industries, municipalities, and other polluters.

Illinois' reorganization is unique. The Illinois Environmental Protection Act of 1970 created three new environmental agencies in 1970. Each is concerned with air, water, land, and noise pollution and public water supplies, but each organization has a different functional focus. The five-member Illinois Pollution Control Board replaces the two former boards for air and water pollution, but unlike the previous boards, it works full time and has staff, funds, and the major policy powers of the state. The Illinois board, one of the most powerful in the country,

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*Elizabeth H. Haskell is a fellow of the Smithsonian Institution's Woodrow Wilson International Center for Scholars. Reprinted from *Environmental Science and Technology*, Volume 5, November 1971, pages 1092-1097, Copyright 1971 by the American Chemical Society. Reprinted by permission of the copyright owner.

FIGURE 1.—*State environmental agencies*

	Institution examined	Estimated budget FY 1971 *	Staff size	Principal official	Policy formation by	Water Pollution	Air Pollution	Solid Wastes	Nuclear Radiation	Pesticides	Noise	Oil Pollution	Municipal Water Supply	Water Use Management	Minerals	Fish	Wildlife	Forests	Parks	Land Use Planning	Land Use Control
Illinois	Pollution Control Board	$ 40,000	18	David Currie, chairman		●	●	●	●	●	●		●								●
	Environmental Protection Agency	6,500,000	366	William Blaser, director	Board	●	●	●			●	●	●								
	Institute for Environmental Quality	2,000,000	9	Michael Schneiderman		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	Total	$ 8,540,000	393																		
Minnesota	Pollution Control Agency	$ 1,185,000	75	John Badalich, director	Board	●	●	●	●	●			●							●	●
Washington	Department of Ecology	$ 6,281,774	254	John A. Biggs director	Director	●	●	●						●							●
Wisconsin	Department of Natural Resources	$43,134,000	1,886	Lester Voigt, secretary	Board	●	●	●		●			●	●		●	●	●	●		●
New York	Department of Environmental Conservation	$40,000,000	2,748	Henry Diamond, commissioner	Director	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Vermont	Environmental Board .... (In Agency of Environmental Conservation)	$ 100,000	2	Benjamin Partridge, chairman	Board															●	●

Maine	Environmental Improvement Commission	$ 85,000 (for land use) of $ 1,000,000 (total)	2	J. Donaldson Koons, chairman	Board	●	●		●
Maryland	Environmental Service .... (In Department of Natural Resources)	$ 413,000	27	Thomas D. McKewen, director	Director	●		●	

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* Includes federal program grants, and state general revenues, but does not include federal funds for municipal waste treatment plants, nor state grants for the same purpose.

sets standards, hears appeals from agency decisions, and adjudicates enforcement proceedings. The Illinois Environmental Protection Agency was created by shifting the antipollution officials out of the health department and into a new, separate agency. It identifies and prosecutes polluters, issues permits, and extends technical and financial aid. A third, completely new organization, the Institute for Environmental Quality, conducts long-range pollution control and land-use planning and research for all agencies of the state.

Full-time departments

By contrast, in Minnesota, Washington, Wisconsin, and New York, environmental programs were consolidated into one new full-time department which performs all daily program functions. Minnesota's Pollution Control Agency was created in 1967 by shifting the water pollution control program out of the health department and adding newly enacted air pollution and solid waste responsibilities. In 1970, Washington created the new Department of Ecology, which combined the same three forms of pollution control, but went one step further and consolidated the program to regulate the withdrawal and use of water. Both Wisconsin in 1967 and New York in 1970 created environmental "super-departments," combining in one new department all pollution controls from the health departments, with their former Conservation Department's resource management activities for fish, wildlife, water, forests, and recreation (Figure 1).

In these last four states, the environmental department is overseen or directed by an interagency or citizen board, which serves part-time in contrast to Illinois' "professionalized," full-time board. In Minnesota and Wisconsin, the boards perform in the same traditional manner, meeting part-time and setting all policy, while in Washington and New York, these part-time bodies are largely advisory (Figure 2).

A first step agreed on in each state was to shift pollution control responsibilities out of the health department to broaden antipollution concerns beyond health and to increase the state's emphasis on legal regulation. It was reasoned that a new administrative agency would be more likely to be concerned with fish and wildlife, recreation, aesthetics, and social and economic interests in pollution control without competition from unrelated health issues.

Benefits of consolidation

In all five states, linking like programs in a new environmental agency was expected to have many benefits. At a minimum, each state combined its air, water, and solid waste pollution programs to avoid state policies that would merely trade one form of pollution for another. The physical phenomenon, that solid, liquid, and gaseous wastes interchange forms during treatment and disposal into the environment, became an unquestioned organizational precept, compelling major anti-pollution programs to be housed under one administrative roof. Planning, management, and control systems, then, could be expected to more closely parallel the integrative network of nature. New York and Wisconsin officials saw further strong program linkages between pollution programs and resource management activities since both affected air, water, land, and living resources.

A mix of other benefits was seen by reorganization supporters. In Minnesota, Washington, and New York, it was further hoped that linking various programs under one director or board would create an agency "advocate" for the environment—someone who could speak out to the public and the legislature in favor of environmental protection issues. A director of an environmental department, where his work was not encumbered by competing program missions, would be free to act as the state's spokesman for the environment. In this way, state issues were expected to be better articulated, and the public could participate more fully in state decision making.

FIGURE 2.— *Environmental boards after reorganization*

State*	Members	Part-time	Full-time	Per diem	Salaried	Governor & Senate	Term (yrs)	Interagency	Industry	Agriculture	Labor	Health	Conservation	Municipalities	Unspecified	"Public"	Policy-making	Approves dept. action	May veto dept. actions	Appoint dept. director	Operational	Quasijudicial	Advises dept.	Nature of previous boards in the pollution control area
ILLINOIS Pollution Control Board	5 employs staff also		●		●	●								5			●					●		1 citizen, 1 citizen and interagency board
MINNESOTA Pollution Control Board	9	●		●		●	4			1				2	8		●							1 interagency board (water pollution)
WASHINGTON Ecological Commission	9	●		●		●	4		1	1	1			1	5									1 interagency, 3 interagency, and citizen boards
WISCONSIN Natural Resources Board	7	●				●	6						4		7		●			●				1 interagency board (water pollution)
NEW YORK Environmental Board	15	●		●		●	6	9	1		4		1					●					●	3 interagency boards
VERMONT Environmental Board	9	●		●		●	4								9		●				●	●		N/A
MAINE Environmental Improvement Board	10	●		●		●	3		2				2	2		4	●				●			N/A

* Maryland's Environmental Service does not have a board.

By contrast, the Wisconsin consolidation of pollution control and conservation programs was intended to eliminate that state's advocacy system in which resource issues had been publicly debated. This process was thought to confuse and "politicize" environmental issues. A super-department might be able to settle many resource and antipollution conflicts internally in a more efficient way.

Nearly all states expected that linking several programs would build a stronger political base for environmental efforts. A new agency would be more visible to the public and be established with executive and legislative endorsements, which would strengthen the agency's power. New York and Wisconsin officials hoped that super-departments would provide a united focus that could encourage various environmental and conservation interest groups to unite their efforts.

Finally, all program consolidations were thought to increase administrative efficiency, cutting down on overlaps and duplications to save public funds. Wisconsin's and Washington's environmental reorganizations were designed to reduce the proliferation of all state agencies and to strengthen the role of the governor in the operation of all state programs. Unlike Wisconsin, Washington did not give active consideration to including conservation programs in the transfer. These are administered in several politically powerful departments. However, Washington's history of interest in consolidating water quality and water quantity programs, plus the need for new leadership in the Department of Water Resources, led to the water-use regulatory activity being combined with pollution control in the new Department of Ecology.

Board and Commission roles

In addition to reducing the influence of the health department and consolidating similar environmental programs in a new agency, a third type of change is common to each state's reorganization process—in the composition and/or role of part-time policy boards.

Air pollution and water pollution control boards were consolidated to broaden their environmental perspective, to match that of the newly created department which they supervised. Furthermore, by reducing the proliferation of part-time boards and commissions, it was hoped to make state governments more manageable and more responsive to the governor. All five states were faced with pollution control boards made up of state officials and/or private citizens—the traditional mechanism by which state governments make pollution control and natural resources policy. The typical role for these old boards was to set all policy, leaving its day-to-day administration to the regular state agency. In the environmental field, an air pollution board or water quality commission had power to set standards, approve the pollution control agency's budget and legislative requests, refer enforcement actions to the Attorney General, and, in some instances, appoint the director of the administering state agency.

These groups came under attack as being inexpert on complicated pollution matters, at best, and, at worst, soft on polluters they were supposed to regulate. Industry, agriculture, and local government board members could, and often did, veto any aggressive state action.

Faced with these flaws, the five states adopted varying solutions. In Minnesota and Wisconsin, the interagency composition was changed to a private citizen one. Washington and, to a lesser extent, New York reduced their boards' policy role to mostly advisory. Illinois professionalized its new board, making membership a full-time job for three years and increasing its capabilities and powers.

Wisconsin and Minnesota continue to operate with old-style boards—that is, part-time, policy-making groups which govern most significant affairs of the agency (including in Wisconsin the appointment of the Secretary of the

Department of Natural Resources). Proponents of the policy boards see them as incorporating many views into decision making for environmental resources and checking any arbitrary action of a department director and the governor.

The single director option

The alternative—a strong single director for an agency appointed by, and serving at the pleasure of, a governor—is viewed in other states as a way of increasing capabilities of state officials and programs, speeding agency response time on crises, and making state officials responsive to the state's chief executive, who, in turn, can be held accountable to the voters.

In Washington, the Ecological Commission can, in theory, veto departmental action, but in reality will probably be mostly advisory. In this state, changing the boards' policy role was a primary reorganization objective of the Republican governor, who initiated the move. However, legislative compromise produced an Ecological Commission with some veto powers and a Pollution Control Hearings Board which reviews departmental actions in a quasi-judicial manner.

During the New York reorganization, which was planned and executed out of the governor's office, a new interagency and private citizen State Environmental Board was created with statutory authority to approve all pollution control standards. However, the extent of this authority is not yet clear, and the Board may very well prove to be mostly advisory. While New York and Washington now have strong director systems, their advisory boards are considered useful as a forum for diverse segments of society to articulate their views and for the state to solicit the cooperation of private citizens and other state agencies on new policies. Appointments to these bodies are also a way for governors to reward political favorites.

Land-use control

The Vermont and Maine land-use control systems are examples of many states' increasing interest in land-use planning and controls to prevent environmental damage. In 1970, both Vermont and Maine established state permit systems to control large commercial, industrial, and housing developments. In Vermont, anyone, including a state agency, planning a development over one acre or a subdivision of more than ten units must first have a permit from the state. If there is a permanent local zoning, the state's permit is required for developments over ten acres, giving the localities an incentive to adopt local controls. In Maine, the state controls all developments over twenty acres or 60,000 square feet of industrial floor space.

The Vermont statute specifically requires the state to draft land-use plans, based on economic, social, and, particularly, environmental values. The permits will implement these planned objectives.

The Maine law has no such specific requirement for land-use planning. Permits for land development in Maine must consider four statutory criteria: financial capacity of the developer, traffic movement, effect on the natural environment, and soil conditions.

Vermont created a statewide Environmental Board that sets policy, is responsible for the land-use plans, and has a quasi-judicial review role over permits, and employs nine district commissions to administer the permit system on a daily basis. The Vermont Board is exclusively a land-use agency, and is located in Vermont's super-department, the Agency of Environmental Conservation.

Maine's institutional structure is not regionalized in this way. Its Environmental Improvement Commission formulates all policy, carries out the operational jobs of reviewing and issuing permits, and also administers air and water pollution control laws. Both the Vermont and Maine systems are designed to control and mold the physical growth of the state.

Waste management agency

The Maryland Environmental Service (MES) was created in 1970. It gave the state a new function which had been left exclusively to local government—the actual construction and operation of solid and liquid waste treatment and disposal facilities. Like land-use control in Vermont and Maine, another type of local function is shifting, in part, to the state level in Maryland.

MES is a public corporation, housed within the Department of Natural Resources, which acts like a statewide sanitary district, to institute a management rather than a regulatory approach to environmental quality. While the New York Environmental Facilities Corporation and the Ohio Water Development Authority have similar powers to construct and operate waste treatment and disposal facilities, only Maryland has specific authority and funds to draft and implement solid and liquid waste facilities plans, in order to institute regional approaches to waste management.

MES can assume its waste control function in several ways:

- Through implementation of the five-year regional plans for solid and liquid wastes,
- Providing the desired facilities or services when a local government or industry requests aid, and
- If an industry or municipality violates a compliance order to conform to water quality standards or regulations governing solid waste disposal, MES can take over the violator's waste treatment and disposal facilities until compliance is achieved, sending the local community the bill.

In these ways, the Service becomes both a regional service institution and a weapon in the state's arsenal to gain compliance with water quality goals and solid waste disposal regulations.

As with Vermont and Maine's entrance into the land-use control field, Maryland's initiation of waste treatment and disposal work does not take all such responsibilities away from local government. In fact, in all three of these situations, the state seeks a partnership arrangement with local government.

Courts and the citizen suit

Michigan is trying a fourth type of institutional approach—assigning a new role to the state courts in environmental protection.

The Michigan Environmental Protection Act gives every public or private entity the right to sue any other public or private entity in state courts to protect the environment and the "public trust" therein. This mechanism of class action lawsuits by private citizens to forestall environmental damage is receiving consideration in many other states as well as at the federal level.

III.4 Environmental planning & management project

Dick Battle *

Prior to the establishment of Metropolitan Government in 1963, Davidson County, Tennessee, included a multiplicity of municipal units including a major city government, several smaller "satellite" cities, a county government, sixteen civil districts and eighty-seven administrative boards and agencies.

The advent of Metropolitan Government, April 1, 1963 with Mayor Briley elected mayor of the new governmental structure, produced a centralized local government with seventeen major administrative boards, a legislature of forty-one council members and service delivery systems and facilities designed around two service districts:

1. The Urban Service District confined to the area of relatively high population density and bounded by the former limits of the City of Nashville as extended by the annexations of 1961-62.
2. The General Services District which is county-wide and includes the total 533 square miles of the county area.

The functions which control environmental quality include: transportation and land-use planning, sewage and surface water drainage, solid waste collection and disposal, health and code enforcement, zoning, water supply, and law. Since all of these functions are administered under Metropolitan Government on a county-wide basis, an opportunity is afforded for the coordination of appropriate department heads into a management team capable of participative planning and the implementation of joint problem solving.

The waste overload problem

Like many of our nation's urban areas, Metropolitan Nashville is faced with many environmental problems. These include the problems of 1,200 daily tons of solid waste and the absence of adequate sanitary landfills for its disposal, untreated industrial wastes overloading sewage treatment facilities and wet-weather overflows from the "combined" sewers of the central city, and air pollution.

Motor vehicle emissions have replaced coal smoke as the top-ranking air pollutant, but the need for a modern, enforceable—and enforced—air resources management program remains a high priority for the city and its environs.

On July 13, 1972 Metropolitan Nashville received a private grant to develop a more efficient structure for management of the environment within the Metropolitan Government. Specifically, the Environment Planning and Management Project (EPMP) was intended to develop a comprehensive regional waste management system including the related problems of air and water pollution, transportation and land-use planning; and to establish an environmental management team in local government.

The main objectives of the project are the following: (1) to define, analyze and describe the problems which preclude efficient environmental management; (2) to determine priorities for the consideration of environmental problems, to establish both short-range and long-range objectives, and to initiate

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training for environmental management "teams," and (3) to utilize the "teams" for the development of skills and management techniques within the existing local governmental structure for continuous achievement after the project is terminated.

The project is organized around a three-member core group representing Metropolitan Government, the Vanderbilt Graduate School of Management, and the Chamber of Commerce. The three-member top management team for the project are representative of the "partnership" arrangement which is one of the strengths of the program: Horton, a representative of the local government and the mayor; Chairman of the Nashville Area Chamber of Commerce Environmental Committee, representing the business, professional and industrial community; and a professor from the University representing the academic community.

The management team includes as permanent members five individuals in high-level positions in the major environmental agencies of the Metropolitan Government: The Metropolitan Planning Commission (two representatives), Department of Health, Department of Public Works, and Department of Law.

As it is designed and implemented, the EPMP coordinates the concern, the ideas and the capabilities of local government, business, industry, finance, and concerned citizens, the university and academic community and agencies of both state and federal government plus the regional planning capabilities of the Mid-Cumberland Council of Governments. An additional interface group is the Urban Observatory of Metropolitan Nashville-University Centers.

Analysis of an issue: meat packing

The project began with a meeting of the "Business Task Force Environmental Ad Hoc Committee" of the Nashville Area Chamber of Commerce. The session ended with unanimous approval that the "packing house industry problem be recommended as the first project for joint action." The EPMP assigned a task force to "study the wastewater problems of the meat packing industry in Nashville." The team began its work in late July and it has continued with substantial success through this year.

The basis of this problem turned on the fact that meat packing plants in Nashville have, in the past years, utilized from one-half to three-fourths of the population equivalent of the capacity of the North Nashville sewage treatment plant. The wastewater sewered from the plants contained suspended solids, grease and other components in excess of limits specified in the amended Metropolitan Wastewater Ordinance. Complicating the problem, the companies in the "meat products' category in Nashville and Davidson County have a total direct employment of more than 1,500 with an annual payroll in excess of $14 million.

The project has led to implementation by the industry of short-run proposals which have substantially reduced the immediate problem. A continuing and essential EPMP effort includes the drafting of an effective regulatory wastewater ordinance which the industry can "live" with.

The importance to the Metropolitan Community of this relatively unpublicized and low-visibility project cannot be overemphasized. Metro's Central Wastewater Treatment Plant, already overloaded and threatened by both state and federal regulatory constraints, cannot continue to receive the untreated solid waste from the meat packing plants. The packing plants themselves, even though working cooperatively with the environmental project, have economic limitations and might be forced either to reduce operations or relocate and rebuild at great expense—and at some economic loss to the Nashville community.

Another accomplishment of the project was the completion of a hydrogeology and water quality analysis of the North Landfill of Metropolitan

Government. This landfill, Metro's largest and one of the four that will be phased out almost immediately, is on a diked flood plain of the Cumberland River. The study was important, not so much as it pertained to the North Landfill (because of its imminent phase out) but because data pertaining to this flood plain would also be applicable to other flood plains of the Cumberland River.

Landfill without water pollution

The results showed that the North Landfill was not polluting the river, and that it is possible to fill in such a way as not to pollute the underground water table. The situation in regard to the hydraulic gradient at the North Landfill was not necessarily true in regard to all landfills, but this knowledge is helpful in locating other fills. Landfills with this same type of geology would probably have the same conditions.

However, the water table study has been more successful than the search for a solution to the solid waste crisis. Metro's immediate need is "at least" 100 acres for new landfills to dispose of the 1,200 daily tons of refuse collected in Nashville-Davidson County by public and private haulers. At this time the solid waste problem takes top priority with both EPMP and Metropolitan Government. There are no easy answers to this problem.

An immediate problem involves organization of an interim collection and disposal system *before* the Nashville Thermal Transfer Plant begins initial operation about twelve months from now.

The thermal transfer plant may be—eventually—the major answer to Metropolitan Nashville's solid waste disposal problem, but that solution is two or three years away. That program plans to use solid waste as a base fuel for conversion to the energy which will provide public and private downtown buildings with heating and cooling at a cost less than required to provide individual systems separately in each building. When the thermal plant begins operation, it will use only about 720 tons of solid waste per day for fuel. That is about half the total tonnage collected throughout the community. Between now and the plant's completion Metro must have more landfille; there will always be some need for this disposal method.

The EPMP is now engaged in the serious business of underwriting a full-time, continuing, one-man research project which will produce a workable, practical collection-disposal system for solid waste. It must fit both the interim, short-run demands of the current crisis and the lesser needs for the first-run (720 tons per day incineration) of the thermal plant.

The project held its first of a proposed series of eight "environmental workshops" on December 5-6, 1972. Over fifty leaders from the public, private and university communities attended. The purpose was "to integrate concurrent programmatic efforts to educate and to invite feedback," and "to plan policy alternatives." An overview and delineation of the "packing house problem" was a major part of the first half-day of the workshop, with "solid waste management in Metro and other interrelated problems of environmental management" completing the afternoon agenda. On the second day, solid waste management and the impact of the Environmental Protection Agency constraints on the local scene were discussed, leaving the last half-day for a work planning session with task force members, project staff and key consultants.

Managing the environment

Lynton Keith Caldwell stated recently in "Environment—A Challenge to Modern Society," that "Environmental administration can be given either of two interpretations . . . [The] first and more apparent meaning is the PURPOSIVE SHAPING OF THE HUMAN ENVIRONMENT BY MAN HIMSELF." This is the interpretation of what man does to his environment in the pursuit of his several and diverse activities. These actions include "his urbanizing, building, land-clearing, mining, industrializing—and his attempts to dispose of whatever he wants to get rid of." Practically everything man does has some impact on his environment. Many of man's actions have a degrading effect on his surroundings, and there is a desperate and critical need to correct the damage before it is too late to cope with the problem. Caldwell suggests that the second, and today the most important, meaning of the term "environmental administration," must be "the control of human action in relation to the environment. Here the direct concern is not with the physical nature in the conventional sense, but with people."

Essentially this must be the impact of the program to achieve significant improvement in management of the environment. The important achievement is the resulting benefits to the people of this community—for the improvement of the quality of life in this Metropolitan community.

The unique "team effort" partnership proposes to utilize all of the community resources and will not overlook the most substantial resource of them all—the concern of the people. "The environment is not administered," writes Caldwell, "it is the actions of people as they impinge upon the environment that becomes the direct focus of attention."

It must be well understood that the public has "a right to know" and this right (with the responsibilities knowledge implies) has a direct bearing on the project. A vehicle within the government to present the problems of the environment and the alternative solutions can provide motivation for the people to demand public action. Metropolitan Nashville can be whatever it wants to be. The urban community, the urban environment, will be what the people determine it shall be.

We must learn to manage growth, change *and* the environment—while we are growing—and decide what goals growth should achieve.

Few cities have been able to absorb rapid growth and change and maintain an improving quality of life. It is our belief that this innovative program will enhance the chances for this accomplishment and that we will be able to look back from the broader perspective of 1980 and say: "We have *become* what we set out to *be*"—and we hope that other leaders will look ahead and set higher goals for the year 2000.

III.5 Regional environmental management and the decision-making process

L. Edwin Coate *

The concept of "Environmental Management" has evolved over the past decade. As the concept evolved, there have been corresponding alterations in the organizations and institutions concerned with these fields. In the early 1970's, in response to a widespread and well articulated public concern, many governmental agencies reorganized to improve their environmental quality delivery capabilities. The Federal government created the Environmental Protection Agency, CEQ, and NOAA. Several states consolidated previously separate environmental functions into new Departments of Environmental Protection.

Local regional efforts lag

Of all the governmental levels, however, I believe that the local/regional official has done the least to reorganize and to develop new methods and techniques to manage the environment. This has been due primarily to lack of funds, lack of time, and confusion as to what needs to be done.

Yet it is the local government official who feels the greatest pressure to clean up the environment. Of the various bureaucrats, he is closest to the problems themselves: the polluted streams, the open dumps, the contaminated air. He is also in the direct line of fire of a public demanding action. Unlike federal and state officials, his responsibility is localized. He cannot evade it by moving about the country or about the state. Whatever tools that currently exist for dealing with the major environmental problems, such as capital budgets, health regulation agencies, and planning resources, are in his control. These tools have proven inadequate on many occasions.

The primary problems facing the local official today and what, in my opinion, the entire issue boils down to is: Who carries out the decision-making process at the regional level, and what information does he need to make the appropriate decision? In matters of the environment, decision making must take place at the regional level. Pollution does not conform to political boundaries. Water pollution needs to be dealt with in terms of river basins; air pollution follows geographical configurations. Problems such as air and noise pollution and solid waste management are beyond the capacity of most local governments to solve without the cooperation of other jurisdictions.

Regional management defined

What exactly do we mean by "regional environmental management"? In the past, we thought it consisted only of pollution regulation. Recently, however, as cost-effective short-term solutions are being exhausted, we see that regional environmental management must be expanded to include the relating of pollution abatement strategies regularly and consistently to the regional land use and transportation planning process. Decision makers are the fundamental users of the environmental management process, and the heart of the local government decision-making process is land use. The heart of the regional governmental decision-

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*Presented by L. Edwin Coate, Director, Integrated Regional Environmental Management (IREM) Project County of San Diego, at the National Conference on Managing the Environment.

making process has evolved to be the transportation-planning process.

In the past, prior to the evolution of the contemporary concept of regional environmental management, just about the only means by which local government managed land-use problems was the planning process. Councils of Governments had the A-95 review process and a comprehensive planning mandate, but no implementation policy. Land-use decisions were still made at the local level and pollution problems were, as a rule, managed by the Health Department. Such functional fragmentation prevented a comprehensive attack on environmental problems.

I believe that the new "art of regional environmental management" has emerged because this process has failed. It has failed primarily because it is based on a fragmented planning approach which does not meet the needs of today's decision makers. As you are well aware, the traditional planning approach involved the setting of goals and objectives, the drawing of comprehensive maps, and the adoption of general plans, with subsequent rezonings to conform to the plans adopted. This is time-consuming, but still relatively neat and uncomplicated. The problem is that in the day-to-day world of local land-use planning and pollution regulation decision making, the general plan is almost always obsolete before adopted, and every case presented is an exception. An example is the "little old lady" who needs a rezone to obtain some value from the property she has held all of her life, or, the essentially insignificant change that might be requested of a local politician by a major campaign contributor. In reality, then, I would propose that the decision-making process is incremental and situational, while the local planning process is neither.

Several recent events have reinforced these conclusions. The federal government passed NEPA, the National Environmental Policy Act of 1969, which required the preparation of Environmental Impact Reports for all federal actions and projects that have a significant effect on the environment. In California, the California Environmental Quality Act (CEQA) was passed. This act, patterned after NEPA, requires EIR's on both public and private projects to be carried out or permitted by all local governmental agencies in the state.

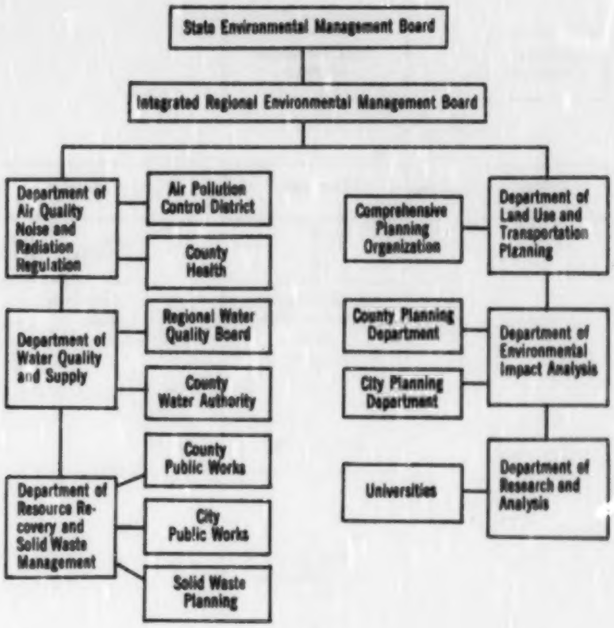
Also in California, Proposition 20, a statewide citizens' initiative, was passed, becoming the California Coastal Zone Conservation Act. This Act provided for the establishment of a series of regional commissions responsible for administering a permit system for all major actions affecting the coastal area in each region.

The EIR process and the regional coastal permit system established by Proposition 20 are clearly a result of the recognition that existing land use and health regulatory institutions have not been able to deal effectively with critical regional environmental problems. They represent attempts to make up for the deficiencies of traditional planning and environmental control strategies by substituting finite, single-purpose systems which are capable of actually implementing a policy. The land-use planning process in particular has simply not been able to provide decision makers with timely, accurate, comprehensive information on which they can base their day-to-day incremental decisions.

It is my feeling that new structures similar to the regional environmental management model shown here (see Figure one) will be developed, using the EIR process, specialized permit systems, and other new regional environmental management tools.

What other kinds of information are necessary inputs into the environmental decision making process? I would propose that an environmental decision-making model might include: cost/revenue information, environmental impact information, environmental indices trend information, and carrying capacity information, as well as traditional land-use planning inputs (a model

FIGURE 1.—APPLICATION OF ENVIRONMENTAL MANAGEMENT MODEL TO THE SAN DIEGO REGION


State Environmental Management Board
Integrated Regional Environmental Management Board
Department of Air Quality Noise and Radiation Regulation
Air Pollution Control District
County Health
Department of Water Quality and Supply
Regional Water Quality Board
County Water Authority
Department of Resource Recovery and Solid Waste Management
County Public Works
City Public Works
Solid Waste Planning
Comprehensive Planning Organization
Department of Land Use and Transportation Planning
County Planning Department
City Planning Department
Department of Environmental Impact Analysis
Universities
Department of Research and Analysis

incorporating these inputs is depicted in Figure two).

Cost revenue inputs

Land-use decision-making bodies in a region now usually consider two principal factors in arriving at approval or disapproval actions: the environmental impact and the economic impact of the project. Unless there is reliable economic impact information available, the environmental impact cannot properly be treated except in those situations in which there is the most severe type of environmental insult. The public costs and revenues associated with a project are felt to be the minimum economic information required.

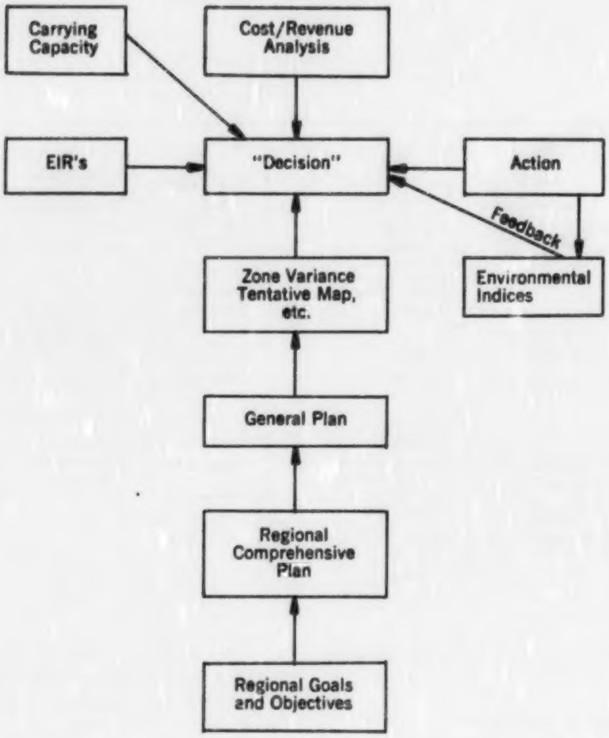
The San Diego joint city/county economic analysis project has resulted in a computer model now being tested on four major local developments. To date, the cost and revenue calculations have been directed toward those jurisdictions (cities, county, special districts, etc.) which are directly affected by the proposed development, that is, those jurisdictions in which the development is "physically" located. In the future, it is clear that consideration must be given to jurisdictions which are indirectly but substantively affected because of employment, transportation, recreational facilities, etc.; thus a substantial amount of additional research will be required on this matter.

We anticipate that within one year, a cost/revenue analysis procedure with acceptable accuracy can be developed to the point where it may be applied routinely to the land-use decision-making process in San Diego county.

Environmental impact reports

The second major factor in land-use decision-making is the determination of

FIGURE 2.—ENVIRONMENTAL MANAGEMENT AND THE DECISION-MAKING PROCESS


Carrying Capacity
Cost/Revenue Analysis
EIR's
"Decision"
Action
Feedback
Zone Variance Tentative Map, etc.
Environmental Indices
General Plan
Regional Comprehensive Plan
Regional Goals and Objectives

the environmental impact of a project. San Diego County has had a policy and procedure for EIR's since April, 1972. Since the *Friends of Mammoth* decision, EIR's are required on both public and private developments. The development of the EIR process by the IREM project has been an arduous and complicated task. We believe, though, that we now have a completely operational system which can provide timely, accurate information to our decision makers on the potential environmental effects of any proposed project. The most innovative components of the San Diego County EIR process include an early warning system and an environmental review board.

Early Warning System: The IREM project staff has developed a computerized early warning system for predicting environmental impacts. For any given geographical site in the region, information concerning natural resources and conditions on and near that site can be immediately retrieved and printed out by a computer.

An *Environmental Review Board:* The Environmental Review Board oversees the preparation of environmental impact reports and coordinates the public review process. The environmental review board consists of the IREM project director, the County Planning Director, the County Engineer and the Director of the Public Health Department. This Board formally coordinates the input from those agencies that deal substantively with these projects. A staff of sixteen supports the Environmental Review Board.

Environmental quality indices

Prediction and feedback are essential to any decision-making model constructed. In San Diego County, the IREM project has recently developed environmental quality indices for air and water quality, noise, energy production and use, solid waste generation and land-use shift.

For the decision makers, these indices will provide important trend information for both pollutants and land use. They will also serve as a feedback showing changes in trends which result from various land-use decisions.

As rational environmental managers, we are concerned with the limitation of our "resources." We must be able to predict the "carrying capacity" of the air, water, land and energy resources of our region to know how much growth, and how much pollution, our region can hold.

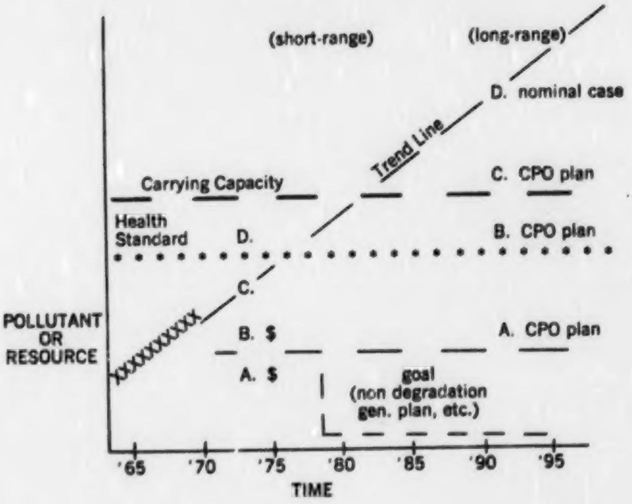
Data now exists in San Diego to predict the growth limits of the physical restraints already listed above. What is lacking is merely the assimilation and analysis of this data and its transformation into forms usable by decision makers. This is now under way in San Diego.

Through the traditional planning process, information on regional goals and objectives can be transmitted to decision makers. Regional goals and objectives are transmuted into a regional plan, the implementation of which is carried out through the zoning process.

New techniques communication

Once the inputs described have been developed to a point where they can regularly support the decision-making process as depicted in the model, the final question is: What is the most effective technique for communicating the information to the decision makers? The technique chosen should be able to show information in a clearly comparative form. The ideal index diagram shown in Figure 3 is a proposed format

FIGURE 3.—THE IDEAL INDEX DIAGRAM



for regional environmental management inputs to both short- and long-range decisions. It is anticipated that for each major decision, a series of these diagrams depicting relevant information in the categories previously described, would be presented to decision makers. These diagrams can depict the proposed action in context with existing trends, its relationship to prescribed environmental standards, the extent of divergence from community or regional plans, and its feasibility, given the carrying capacity of the region. Further work is currently being conducted in San Diego on the development of this information display technique.

Future needs

There is one additional input which must ultimately be included in the model. This is the quantification and presentation of social impact information. Eventually, this requirement may be met by the inclusion of social impact data in Environmental Impact Reports or by separate "Social Impact Reports" similar to EIR's. Perhaps the optimal situation in the future would be an overall requirement that each major land-use decision be accompanied by the Quality-of-Life Impact Report. The Quality-of-Life Report would include current, comparative information of environmental, economic and social impacts related to specific aspects of the planning process.

IV: Citizen Participation in Environmental Management

CITIZEN PARTICIPATION IN ENVIRONMENTAL MANAGEMENT

> "A major reason for citizen participation having successfully resisted generalization is the absence of a sizable enough body of empirical evidence from which to draw meaningful inference and conclusion. The evidence we do have is contradictory, inconclusive, particularistic, and overly qualified by the dictates of time, place, and circumstance." [1]

There is a growing awareness of the importance of citizen participation in the decision-making process. Traditionally, many government officials have not often sought the opinions of citizens about environmental concerns for a number of reasons: time constraints, the presumed lack of knowledge and/or interest on the part of the public, the technical nature of the problem, lack of a suitable mechanism for obtaining outside opinions, or simply oversight. However, times have changed and citizens are now demanding a greater and more consistent role in environmental decision making. Some of the reasons for this include the following: the effects of pollution are being seen and felt by the public; helping to "save the environment" has been popularized; the press and educational institutions are creating a better-informed public; and finally, environmental deterioration has reached such proportions that major changes in life style may be required in some areas. For these reasons, it is no longer possible for a small number of public officials, no matter how competent, to unilaterally create and enforce environmental programs.

Recent legislative requirements, e.g., the 1972 amendments to the Federal Water Pollution Control Act, reflect the practical necessity of seeking citizen input. In addition, citizens are demonstrating their eagerness to contribute to a better environment by personal volunteer efforts. These efforts are usually conducted by groups formed specifically for environmental purposes, such as the Isaak Walton League; groups which have environmental interests as well as other concerns, such as the League of Women Voters; and individuals practicing conservation in their personal lives. The emergence of recycling centers is an example of a citizen-conceived movement, often arising without official sanction. While the viability of recycling as a solid waste management strategy under the existent market system is debatable, it is a demonstration of the popular sentiment for conservation of resources.

LEVELS OF CITIZEN CONTROL OVER DECISIONS

Citizen participation can take many forms; there is no simple formula for achieving it. Local conditions must always be taken into account in establishing, administering, and evaluating citizen participation. The meaningfulness of citizen participation can be described in terms of the following ladder ranging from high involvement to nonparticipation.

TABLE 1.—*Levels of citizen involvement*[2]

Increasing Degree of Citizen Paticipation. ↑

Citizen Control
Delegated Power
Partnership
Placation
Consultation
Informing
Therapy
Manipulation

This "Ladder" as presented by Sherry R. Arnstein in the Journal of the American Institute of Planners, is referred to in a lecture on techniques for involving the citizen in the urban transportation planning process by Daniel S. Cohen, U.S. Department of Transportation:

> The lowest two levels—manipulation and therapy—describe levels of "nonparticipation." The objective of this type of participation is not to enable people to be actually involved in planning or conducting programs, but to enable powerholders to "educate" or "cure" the participants.
>
> The levels of informing, consultation, and placation are higher levels of participation. In these cases, citizens' views are heard but there is no assurance they will be heeded.
>
> Further up the scale are levels of citizen power with increasing degrees of decision-making power. The partnership level allows citizens to negotiate and engage in trade-offs with traditional powerholders. This level of citizen participation is characterized by two-way communication between the planning staff and the citizens.
>
> At the topmost level are delegated power and citizen control. In these cases, the citizens have the majority of the decision-making seats or the full managerial power.
>
> A question which can be asked from this discussion of levels of citizen participation is, which level(s) is appropriate for the urban transportation planning process? As was mentioned previously, the approach to public involvement will vary between communities, and it is the responsibility of the decision makers in each community or region to decide the appropriate level.[3]

PARTNERSHIP BETWEEN CITIZENS AND THEIR GOVERNMENT

The "partnership" relationship between the government and citizens deserves description because of the potential benefit for both partners. Public administrators who treat citizens as partners in striving for their common goals of environmental quality are not only aware of independent citizen groups and activities, but take positive action to work together and facilitate their programs. Returning to the example of recycling, public administrators would aid the viability of the recycling effort by using their position to press for changes in the economic and political barriers to recycling, such as prejudicial freight rates and depletion allowances. For example, a National League of Cities task force composed of mayors and city administrators recently made recommendations to enhance recycling resource recovery programs by the adjustment of federal policies that negatively impact resource recovery. If, on the other hand, the reclamation process itself is inherently too costly for recycling to work, citizens should be informed and redirected to more fruitful endeavors. The public official in a partnership role with citizens would not merely fulfill the legal and practical requirements in dealing with the public; he would also play an active role in the provision of environmental education and in utilizing public volunteer efforts where appropriate.

In Scottsdale, Arizona, an experimental program which utilizes citizens as a "resource" was undertaken in response to a citizen's recycling proposal for the city. To test the program proposed by the citizen in which homeowners were required to separate their own garbage, an experimntal area of several square blocks was designated. Newspapers, glass, and other garbage were collected separately, the newspapers and glass then taken to recycling centers. These homeowners were the participants in an experiment on one aspect of the feasibility of recycling as a long-range strategy. Regardless of the outcome in the particular case of recycling, the willingness of the local government to share the decision-making process and to treat citizens as partners is important for establishing a productive and harmonious relationship between citizens and government.

The mechanisms and strategies for obtaining citizen participation which are described in this chapter should be considered a starting place in the development of meaningful interaction between government administrators and citizens. The most important ingredient in a successful citizen participation program is still the responsiveness and interest of the government official; without that interest, even the most sophisticated citizen participation mechanisms are doomed to failure.

VOTING

Voting is the most fundamental form of citizen participation. However, in addition to the right of citizens to select their representatives, citizens also have the power to approve or disapprove bond programs and to vote on specific community issues raised in referenda.

The ballot box can be used as a positive strategy by citizens for effecting environmental goals. For example, the proposed 1976 Colorado Olympics were blocked by citizen action. Several citizens in the Denver area became suspicious that the projected cost figures for the Olympics were quite low compared to the actual cost of the Sapporo Olympics. Citizens in Evergreen community were also aroused because they had not been consulted in the planning stages, and they objected to the construction of parking lots and other detractions to their peaceful location. A citizens' group was formed in early 1972 called the Citizens for Colorado's Future (CCF). The group was funded by contributions. In order to get the referendum put on the state ballot, a petition with 51,000 signatures was needed (the number was based on a percentage of the number of votes cast in the previous election). The CCF actually obtained 76,000 signatures. In addition, the referendum was also placed on the City of Denver's ballot to assure that the City would not proceed independently of the State. CCF campaigned for the referendum through the media and handouts. On November 7, 1972 (Election Day) the referendum won on both ballots, with 180,000 plurality in the statewide vote.

PUBLIC HEARINGS

Public hearings are the most frequently used method for obtaining citizen participation due to the frequent legal requirement for public hearings; however, their usefulness is severely limited unless combined with other participation strategies.

Gerald Springer, Vice Mayor of Cincinnati, Ohio, discussed three basic weaknesses of the traditional methods of citizen participation at the Conference, particularly the public hearing: (1) The emphasis is on procedures rather than on responsiveness; they are performed as prescribed but the information received is not necessarily incorporated in any systematic way to the planning pocesses. (2) Often vital information is not given to the citizenry; then their suggestions are discounted due to their "lack of expertise." (3) Citizen input is defensive in nature because it is often solicited after-the-fact, rather than in the earlier planning stages when change is still feasible. Furthermore, the public has no way of knowing whether the opinions expressed at the hearing have actually had any effect on the outcome. It is a one-way communication channel because of the typical structure of the meeting: The first half resembles a "staff briefing" with the lengthly explanations of the proposed plans; during the second half, the citizens virtually talk to each other, with little or no feedback from the staff. If the opinions voiced by the citizens do not appear to have affected the final outcome, even if there was good reason for not adopting their suggestions, citizens can become frustrated and angry.

CITIZEN ADVISORY BOARDS

A popular mechanism for obtaining citizens' viewpoints is via appointed citizen advisory boards. Typically there are two rationales used in selecting the board members. One is to select a cross section of the population to create a microcosm of the community. This type of board is particularly useful for soliciting their opinions on proposals before public release, assuming that the board's reactions would be a fair sample of the community reaction. The other rationale is to select members on the basis of their expertise in specified fields. This interdisciplinary group is most useful for performing studies and making recommendations to the city administration. Rather than emphasizing "the citizen viewpoint" per se, this type of board utilizes resources available within the population.

In Cincinnati, the Citizens' Environmental Task Force has completed a detailed year-long study of Cincinnati's environmental problems. The Task Force is composed of about 30 private citizens who have expertise in specific environmental areas and serve without compensation. The major areas which they investigated were air, water, noise, land use, solid waste, and energy conservation. Their report to the City Council was submitted in June, 1973, in a 250-page document to be publicly released.

The Cincinnati Citizens' Task Force consists of a Chairman, appointed by the mayor and approved by the City Council; an administrative assistant and secretary, hired by the Task Force Chairman; a Vice-Chairman, appointed by the Chairman; and six subcommittees. Each subcommittee selected its own chairman. Each subcommittee was charged with writing the final report and recommendations in its area. They held at least one public hearing, submitted status reports at the Task Force meetings, and distributed the minutes of their meeting to all the committee members.

The Dallas, Texas Citizens' Environmental Quality Committee was established in July, 1971. It was "charged with the development of a city-wide environmental policy encompassing the activities of both government and private entities. The primary goal was to identify citizen perceptions and ambitions and not to design the strategy or the machinery for the achievement of goals," according to George Schrader, City Manager of Dallas. The committee was multidisciplinary in composition and received staff support from employees who worked full-time with the committee in defining and researching problem areas. Mr. Schrader described the activities the committee has been performing: "The initial fact-finding phase consisted of the acquisition of personal testimony from city program administrators, regional urban affairs officials, and state and federal agency officials. Written statements were also solicited from a select group of local scientists, educators, conservationists and community leaders. More recently, the committee held public hearings to obtain further knowledge of the citizens' perceptions of the problem. Based on this varied input, the committee began composing policy recommendations last March and will present their findings to the City Council in late June, 1973. This effort will certainly significantly influence future city activity."

An advantage of citizen advisory boards is the provision of two-way communication at regular meetings, with continuity of interaction. Staff support from the city administration strengthens the board's effectiveness and credibility. The disadvantage of these boards, however, is the tendency to rely upon the citizens' board to the exclusion of the remainder of the population, on the assumption that the board represents the citizenry as a whole.[3]

CONSERVATION COMMISSIONS

A special type of citizen board is the conservation or environmental commission which is an official agency of local government consisting of citizens who are appointed to serve without compensation for a fixed term. These commissions derive their legitimacy from state enabling legislation and municipal ordinance, having accessibility to state and federal funds, and permitting intra- and inter-municipal action. The first such commission was created in Massachusetts in 1957, and others have subsequently been adopted in other New England and northeastern states.

The activities of these Commissions include acquisition, coordination, and planning for the protection of the environment. The coordinating role enables commissions to work with local environmental groups. In Hanover, Massachusetts, the Conservation Commission became the coordinating body in a group effort to protect and preserve the North and South rivers. Commissions can become a focal point for the organization of environmental projects, and can provide the impetus for natural resources planning. In addition, commissions may, subject to approval of the governing body, acquire property in the name of the municipality by gift, purchase, grant, bequest, devise or lease, and are empowered to administer the use of that land. Besides these special powers, commissions are also empowered to conduct studies and make recommendations in the same manner as other citizen boards.

The most important difference between advisory boards and conservation commissions is state sponsorship, eligibility for state funding, and the ability of the commissions to acquire and control land. The need for comprehensive planning before selecting the sites for acquisition tends to put the emphasis on conservation and open space rather than on pollution abatement.

Whether the commission approach will prove to be applicable to large cities, varying so greatly from the typical New England town where these commissions developed, is a question which remains to be answered; as one meaningful approach to the involvement of outsiders in the governing body, the conservation commission has many advantages.

LEGAL ACTION

Individual citizens and citizens' groups have the legal right to help decide the future of the environment. John Goodman of Technical Assistance Research Programs cites the legal requirements for public participation which government administrators cannot afford to ignore. Section 101(e) of the Federal Water Pollution Control Act stipulates that public participation shall be "provided for, encouraged and assisted by the [EPA] Administrator and States" in the "development, revision . . . of any . . . plan or program established by the [EPA] Administrator or State." The proposed regulations to implement section 101(e) emphasize the need for public participation in the early stages of decision making.

> ". . . active public involvement in and scrutiny of the intergovernmental decision making process is essential . . . Conferring with the public after an agency decision has been made will not meet the requirements of this part." (40 CFR 105.2)

The guidelines also require that before any agency action is taken on a plan or program, such as approving a construction grant application, a "summary of public participation" must be submitted.

A citizen has the right to take court action against any violator of his rights. Under the Refuse Act of 1899, individual citizens can report the illegal discharge of effluent into navigable waters; if the report leads to a conviction, the citizen is awarded one-half of the amount of the fine.

The establishment of a local board of appeals is a formal mechanism for receiving citizen appeals. Gerald Springer describes the Cincinnati board of appeals established under their air pollution control ordinance. Individual citizens or groups can appeal decisions made by the administration, and the board has authority to override the earlier decision. Norman Redlich, Corporation Counsel for the City of New York, describes the creation of the City's Environmental Control Board, an administrative tribunal for enforcement of the provisions of the City's codes and ordinances. It hears citizen complaints and has the option to decide whether or not to prosecute on the basis of a complaint. If the Board declines to prosecute, the citizen may proceed at his own expense. If a conviction is obtained, the citizen receives a bounty, based on a sliding bounty system whereby the percentage of the fine the citizen receives is greater if the city was wrong and failed to prosecute.

Suits brought by environmental groups and individuals play an important role in checking the actions of government officials at all levels. Often citizens have been successful: in enforcing stronger provisions than the government would have done, e.g., the Greater-Washington Alliance to Stop Pollution, Inc. (GASP) proceedings against the Washington Metropolitan Area Transit Commission (WMATC); and in the discovery of new enforcement mechanism, as when Congressman Henry Reuss in 1971 brought suit against 270 companies in his home state of Wisconsin in order to establish the power of the 1899 Refuse Act.

EDUCATION

The importance of a well-informed citizenry is an essential prerequisite to achieving meaningful citizen participation. Citizens often require a basic education on the issues, in addition to the latest developments. This is particularly true in the field of the environment because it is a relatively new concern and because of the recency of much of the information.

In Dallas, an environmental public information program is one attempt to meet the educational needs of the public. George Schrader, City Manager of Dallas, describes an exhibit which presented various environmental options for a future Dallas which was co-sponsored by the Dallas Museum of Fine Arts and the City:

> ". . . The show went beyond the traditional approach of presenting facts and figures in a passive format. The exhibit involved direct spectator participation by requiring the viewer to make decisions on specific housing, transportation, recreation and urban design alternatives.
>
> The display consisted of a labyrinth of tunnels, each passageway representing a specific option. Before being exposed to the various externalities associated with each option, the participant was asked to choose and record all decisions on a questionnaire. The exhibit then culminated in a six-screen audio-visual display which explored the future implications of each decision. In this manner, the public was informed not only about the current tradition of our local environment but also about the trade-offs involved in decision making relative to guiding the future of Dallas. This information emphasized to the citizens the existence of environmental options and choices which will in the future be made by omission or commission."

Mr. Schrader also mentions another educational program in the City of Dallas public school system:

> ". . . The City of Dallas, the American Institute of Architects, and the American Society of Landscape Architects have recently joined

> a privately sponsored Community Design Center in developing a pilot project within the local public school system. Aimed at grades five through seven, the project will consist of a careful environmental study by the students of the neighborhood surrounding the school; communication of the results of the study to peers and adults through written descriptions, drawings, photographs, films, tape recordings, oral reports, models, etc.; and efforts at the implementation of the reported suggestions made by the participating children.
>
> The role of the City will be to provide assistance for teachers in the initial planning phases as well as in the implementation phase. Ultimately, the aim is to develop a packaged program as a result of the pilot experiences."

An effective method for citizen education which Mr. Goodman and his colleagues describe is to hold special workshops for citizens. By scheduling workshops on a particular topic early enough in the planning stage of a project, a group of interested and informed citizens will be able to provide valuable reactions to preliminary plans. Workshops should be small enough to encourage discussion and communication in addition to teaching. Ideally, local planners and administrators with expertise in the subject matter should be present at each workshop meeting. Workshops should not be held only at the inception of a project but should be offered routinely to create an ongoing citizen/local official communication and educational mechanism. In this regard, Mrs. Ruth Clusen, Vice-President of the National League of Women Voters, stresses the need for citizens and groups to know the steps of the governmental processes including what individuals to contact on various matters. The workshop should be the initial contact between citizens and the governing body, designed to encourage future interaction as well as to inform the citizen on the particular topic.

An important incentive to the pursuit of active citizen involvement through workshops is the provision in federal construction and planning grant regulations that workshops are an allowable expense; seventy-five percent of the cost of a workshop connected with a specific project can be financed through a federal grant.

GENERAL ADVICE FOR IMPLEMENTATION

Mrs. Ruth Clusen, drawing upon her experience as the Vice-President of the League of Women Voters, offers advice to government administrators on dealing with the public. The first suggestion is not to patronize or talk down to a citizen; it is preferable to assume that the citizen knows more than he actually does than to treat him as what Mr. Springer humorously described as the "proverbial dumb layman." Second, involve people from the beginning, rather than inviting them in to rubber stamp a "fait accompli." All of the speakers emphasized this obvious but often ignored necessity. Third, be frank and honest to citizens and do not hesitate to describe the trade-offs involved. Offer technical assistance including scientific, technical and professional advice; citizens usually lack the resources to acquire the needed information. Workshops and educational programs were discussed by Messrs. Goodman and Schrader as methods to meet this need. Fourth, do not expect support on every subject. Fifth, spell out the processes and complexities of government, including referral to individuals within the system who can offer further assistance. Do not consider citizen participation an adversary procedure; it can and should be a productive interchange. Finally, receptiveness to the ideas and opinions of citizens is essential.

Notes for Chapter IV

[1] Hans B. C. Spiegel (ed.), *Citizen Participation in Urban Development* (NTL Institute for Applied Behavioral Science, 1968) Vol. 1, pp. 3-4.

[2] Sherry R. Arnstein, "The Ladder of Citizen Participation," Journal of the American Institute of Planners, July 1969, as referred to in:

U.S. Department of Transportation, Federal Highway Administration, Lecture 5 by Daniel S. Cohen: "Goals, Objectives, and Evaluation Criteria."

[3] Alternates to the structures and uses of citizen advisory boards are discussed by Michael P. Ryan in "The Role of Citizen Advisory Boards in Administration of Natural Resources," *Oregon Law Review*, Vol. 50, 1971 (p. 153).

IV.1 Public participation in EPA's water-pollution control activities

The following guidelines indicate the depth of commitment within the Environmental Protection Agency to the goal of public participation. Specifically addressed to activities in the water pollution control arena, the first part of these guidelines is written by Acting EPA Administrator John Quarles and presents an analysis of the public response to the first publication of the proposed guidelines. The second part sets forth the procedurai methods to be used in encouraging and adjusting to popular participation. Both sections have been edited of some tangential paragraphs. The full text appears in the Federal Register, Volume 38, No. 163, pp. 22756-22758,—R. Laska, ed.

EPA and public participation

On February 23, 1973, the Administrator of the Environmental Protection Agency proposed regulations specifying minimum guidelines for public participation in certain processes under the Federal Water Pollution Control Act, as amended. Section 101(e) of the Act requires the Administrator, in cooperation with the States, to develop and publish such regulations, and to provide for, encourage, and assist public participation in the development, revision, and enforcement of any regulation, standard effluent limitation, plan or program established by the Administrator or by any State under the Act.

The regulations are a general statement of policy, setting forth objectives in public participation. They describe the provisions required in a minmum public participation program at State and Federal levels of governmental activity for water pollution control, call for a summary report on public participation efforts in relation to certain actions, and give minimum procedural guidelines for public hearings. Other regulations in Chapter 40 provide more explicit requirements for public hearings and other procedures related to particular programs under the Act.

The regulations are based on the evident intent of Congress that public participation under the 1972 Act is to be accorded new significance, and that special attention and resources will be required. Emphasis for public involvement is placed at three levels: First, in development of statewide programs, including priority lists for allocation of resources; second, in preparation of basin and areawide plans involving selection among alternative systems and projects; and third, in the case-by-case consideration of local projects and permit applications.

Public responses

The proposed regulations published had been developed with informal participation of and suggestions from numerous persons, including representatives of several citizen and conservation groups, trade organizations, governments, and other interests. The States had an opportunity to comment on the proposed regulations in draft form.

Further public and government comment was sought upon publication of the proposed rules. More than fifty sets of written comments, as well as a number of verbal comments, were received and reviewed. The Environmental Protection Agency has carefully considered all submitted comments. All written comments are on file with the Agency. Many suggestions have been adopted or substantially satisfied by editorial changes in, deletion from, or addition to, the guidelines. These and other principal comments are discussed below.

1. Several commenters expressed concern that the guidelines did not provide sufficient opportunity for public participation in establishment of the state program for public participation. The language of § 105.3, "Required Program and Reports," has been modified to clarify the concept that this is an integral part of the overall state program for water pollution control, subject to continuing public scrutiny and consideration, as well as to annual review and approval by the Regional Administrator.

2. In § 105.4, "Guidelines for Agency Programs," each of the § § 105.4(a) through 105.4(c) has been edited in response to comment by citizens and conservation groups to describe more precisely the elements that should make up an agency public participation program. . .

4. In § 105.4(e), "Access to Information," the listing of specific material to be made available for public reference has been deleted. Specifying material increases the possibility that other relevant material might be overlooked or omitted. Certain information, such as grant applications, is more useful in final submission form than as working materials. . .

6. Numerous commenters questioned the negative language originally proposed in § 105.4(f), "Enforcement." This has been changed to read: "Public efforts in reporting violations shall be encouraged . . ." Additional provision has been made to ensure follow-up to such reporting.

7. Conservation and citizen groups argued for stronger provision for prior public notice on out-of-court settlements under § 105.4(g), "Legal Proceedings." This provision has been modified to reflect the July 17, 1973, Statement of Policy by the Department of Justice providing for public comments on consent decrees involving discharge of pollutants in the environment. . .

States note extra burden

9. Numerous comments, notably from State governments, called attention to the burden placed on their resources in efforts to meet the public participation requirements. These regulations have been prepared with full consideration for section 101(f) of the Act which focuses on the need for minimization of paperwork and the best use of available manpower and funds. The simple device of a public statement or "Summary of Public Participation" as called for in § 105.5, "Guidelines for Reporting," was strongly endorsed by many citizen groups as a means of encouraging agency efforts to improve public participation without generation of execessive paperwork.

10. Almost all citizen groups responding to publication of the proposed regulations called for stronger provision in § 105.6, "Guidelines for Evaluation," for action on the Summary of Public Participation. The opening paragraph has been revised to indicate clearly that a Regional Administrator may reject a plan or grant application if he finds inadequate public participation. Although many commenters wanted a separately published evaluation of the Summary of Public Participation, this was felt to be contrary to the objective of section 101(f) of the Act. The findings on public participation, however, are to be incorporated into the action documents on a plan, grant application, or other matter.

11. Paragraphs (a) through (g) of the Evaluation section, § 105.6 have been omitted. To include these in the regulations would invite excessive legal interpretation, resulting in voluminous paperwork and records. These paragraphs proposed in the published guidelines as suggested measures of evaluation, will be incorporated into material for regional office guidance. The supplementary material, of less rigid format than regulations, will include additional points suggested in comments received. . .

13. In commenting on § 105.7(d), "Hearing Notices," numerous groups representing both industry and conservation interests stressed a need for

more adequate time to prepare organizational response to proposed agency actions. Their comments recommended notice of 45 to 60 days in advance of hearings. The stated 30-day advance notice, however, is consistent with established practice. . .

16. Several commenters raised questions on the right of appeal when citizen views had been ignored or not adequately provided for. This right is not separable from other aspects of the water pollution control programs in which normal channels of communication to adminstrators are open and provisions for citizen suit are available.

17. A few commenters representing varied interests requested specifically naming industrial groups or representatives of the urban poor and minorities in relation to certain provisions for access or participation. It was felt that naming such interests would imply exclusion of other interests and it would be unwise to attempt to narrow the definition of "public" in any way.

Public participation in water pollution control

This part sets forth minimum guidelines for public participation in the processes of development, revision and enforcement of any regulation, standard, effluent limitation, plan or program under the Federal Water Pollution Control Act, as amended. in accordance with section 101(e) of the Act. This part is applicable to all Environmental Protection Agency (EPA) components concerned with the Federal Water Pollution Control Act, including EPA Headquarters program offices and divisions, and EPA Regional Offices, and to States and interstate agencies. These guidelines contain general requirements applicable to regulations, standards, effluent limitations, plans and programs. More specific requirements applicable in specific areas are contained in existing regulations on Public Information (Part 2 of this chapter) and in other regulations that have been or will be issued pertaining to various specific programs under the Act, as well as State and local laws pertinent to the subject.

Policy and objectives

Participation of the public is to be provided for, encouraged, and assisted to the fullest extent practicable consistent with other requirements of the Act in Federal and State government water pollution control activities. The major objectives of such participation include greater responsiveness of governmental actions to public concerns and priorities, and improved popular understanding of official programs and actions. Although the primary responsibility for water quality decision-making is vested by law in public agencies at the various levels of government, active public involvement in and scrutiny of the intergovernmental decision-making process is desirable to accomplish these objectives. Conferring with the public after a final agency decision has been made will not meet the requirements of this part. The intent of these regulations is to foster a spirit of openness and a sense of mutual trust between the public and the State and Federal agencies in efforts to restore and maintain the integrity of the Nation's waters.

Required program and reports

Each agency cited in § 105.1 carrying out activities under the Act shall provide for and conduct a continuing program for public participation comprising substantially the elements listed in § 105.4. Staff responsibility and budgetary provisions shall be identified for such program in the administration element of the annual State program submission under Part 35 Subpart B of this chapter. Public participation activities shall be reported on annually and in relation to certain documents and actions as called for in § 105.5.

Guidelines for agency programs

The continuing agency program for public participation shall contain mechanisms or activity for each of the elements listed in this section. The exact mechanism and extent of activity may vary in relation to resources available, public response, and the nature of issues involved.

(a) *Informational Materials.*—Each agency shall provide continuing policy, program, and technical information at the earliest practicable times and at places easily accessible to interested or affected persons and organizations so that they can make informed and constructive contributions to governmental decision-making. News releases, newsletters and other publications may be used for this purpose. Special efforts shall be made to summarize complex technical materials for public and media use.

(b) *Assistance to Public.*—Each agency shall have an arrangement for providing technical and informational assistance to public groups for citizen education, community workshops, training, and dissemination of information to communities. Requests for information shall be promptly handled.

(c) *Consultation.*—Each agency shall have standing arrangements for early consultation and exchange of views with interested or affected persons and organizations on development or revision of plans, programs, or other significant actions prior to decision-making. Advisory groups, ad hoc committees, or workshop meetings may serve this purpose.

(d) *Notification.*—Each agency, for its appropriate geographic area, shall maintain a current list of interested persons and organizations, including any who ask to be on such list, for the periodic distribution of materials in paragraph (a) of this section. Each agency shall additionally comply, in connection with any public hearing or other proposed action, with any format or specific requirements for public notice called for in the Act or in other regulations, to be supplemented wherever possible with informal notice to all interested persons or organizations having requested in advance such notice.

Information access

(e) *Access to Information.*—Each agency shall provide, either directly or through others, in an appropriate location or locations, one or more central public collections or depositories of water quality reports and data pertinent to the geographic area concerned. Examples of the materials available for public reference could include grant and permit applications, permits, effluent discharge information, compliance schedule reports, and materials specified in section 308(b) of the Act. Copying facilities at reasonable cost shall be available.

(f) *Enforcement.* — Each agency shall develop internal procedures for receiving and ensuring proper consideration of information and evidence submitted by citizens. Public effort in reporting violations of water pollution control laws shall be encouraged, and the procedures for such reporting shall be set forth by the agency. Alleged violations shall be promptly investigated by the agency.

(g) *Legal Proceedings.*—Each agency shall provide full and open information on legal proceedings under the Act, to the extent not inconsistent with court requirements, and where such disclosure would not prejudice the conduct of the litigation. Actions of the Environmental Protection Agency shall support and be consistent with the Statement of Policy issued by the Department of Justice with regard to affording opportunities for public comment before the Department of Justice consents to a proposed judgment in an action to enjoin dischargers of pollutants into the environment. (See Title 28, Code of Federal Regulations, Chapter 1, § 50.7.)

(h) *Rule Making.*—In addition to providing an opportunity for public hearings on proposed regulations, where appropriate or required under applicable statutes or regulations, agencies shall invite, receive, and consider comments in writing from any interested or affected persons and organizations. All such comments shall be part of the public record, and a single copy of each comment shall be routinely available for public inspection. Notices of proposed rule making, as well as final rules and regulations, shall be distributed to interested or affected persons as quickly as possible after publication. Each notice of proposed rule making shall include information as to the availability of the full texts of proposed rules and regulations (where these are not set forth in the notice itself) and as to the designated places where copying facilities shall be available at reasonable cost to the public.

(i) *Other Measures.*—The listing of specific measures in this section shall not preclude additional techniques for obtaining, encouraging, or assisting public participation.

Guidelines for reporting

The annual report of each EPA unit or office, and the annual State program submission under Section 106 of the Act as required under Part 35 of this Chapter, shall include a description of public participation provisions and activities. In addition, and in order that the public and reviewing or approving officials may be fully aware of the actual extent of public input and involvement, a Summary of Public Participation related to particular actions or documents shall be publicly presented as follows:

(a) In the case of regulations and standards required to be published by the Administrator in the FEDERAL REGISTER or required to be published by a State agency in an official form, the Summary of Public Participation shall be published as part of the introductory material.

(b) In the case of Statewide or areawide plans or portions thereof (including the continuing planning process under section 303(e) of the Act and plans developed under such process), or comparable matters required to be approved by the Administrator, the Summary of Public Participation shall be submitted as a part of the plan or of the public transmittal document.

(c) In the case of applications for grants for construction projects other than those under section 206 of the Act, or for planning or annual program grants, the Summary of Public Participation shall be a part of the application.

(d) Each Summary of Public Participation shall describe the measures taken by the agency to provide for, encourage, and assist public participation in relation to the matter; the public response to such measures; and the disposition of significant points raised.

Guidelines for evaluation

The Administrator, Regional Administrator, or other approving official shall review and evaluate each Summary of Public Participation in relation to the matter submitted. He may call for additional information, or for the records of meetings or hearings. If he finds that there has been inadequate opportunity for public participation on the matter, he may disapprove or suspend action; or alternatively take measures, or require the sponsoring agency to take measures, to obtain additional public participation, prior to final action. Such final action shall include a statement of findings in regard of public participation.

Guidelines for public hearings

Any public hearing, whether mandatory or discretionary, to be held under the Act shall be in conformity with this section. If conflict exists between the minimum guidelines of this section and requirements of State or Federal law or other regulations pertaining to a particular hearing, the more stringent requirements shall be observed.

(a) *Purpose.*—Generally, a public hearing gives persons and organizations a formal opportunity to be heard on a matter prior to decision-making. Although public hearing testimony may focus on the prospective action to be taken in the form of a tentative plan or decision, the final actions shall benefit from and reflect consideration of the public hearing content.

(b) *Public Meetings.*—Agencies are encouraged to hold public meetings or workshops, jointly where feasible, on significant matters or proposed actions. Such meetings shall not supplant public hearings when such are required, and shall be informational in nature with opportunity for public response.

(c) *Opportunity for Hearings.*—Where the opportunity for public hearing is called for in the Act, and in other appropriate instances, a public hearing shall be held if the hearing official finds significant public interest (including the filing of requests or petitions for such hearing) or pertinent information to be gained. Instances of doubt should be resolved in favor of holding the hearing, or if necessary, of providing alternative opportunity for public participation.

(d) *Hearing Notices.*—In addition to any other formal legal requirements, a notice of each hearing or public meeting shall be well publicized and be mailed to interested or affected persons and organizations as soon as the hearing or meeting is scheduled by the agency and in the case of a hearing, at least thirty calendar days before the hearing is to take place. If it should be necessary to allow less than thirty days' notice prior to a hearing, the hearing notice shall state the reasons for such shorter time period.

(e) *Location and Time.*—In determining the locations and times for hearings, consideration shall be given to easing travel hardship and to facilitating attendance and testimony by a cross-section of interested or affected persons and organizations. Accessibility of hearing sites by public transportation shall be considered.
ments, and data to be discussed at the

(f) *Documents.*—Reports, docu-
public hearing shall be available to the public for a reasonable time prior to the hearing. For complex matters, a Fact Sheet outlining major issues, tentative staff determinations if appropriate, bibliography, and procedures for obtaining further information, for requesting a public hearing, and for other appropriate actions shall be prepared and its availability made known in the notice called for in paragraph (d) of this section.

(g) *Agenda.*—The elements of the public hearing, proposed time schedule, and any constraints on statements shall be specified in the notice of the hearing.

(h) *Scheduling.*—Witnesses at public hearings shall be scheduled in advance when necessary to ensure maximum participation and allotment of adequate time for testimony, provided that such scheduling is not used as a bar to unscheduled testimony. Blocks of time shall be considered for major categories of witnesses. Evening and weekend schedules shall be considered.

(i) *Statements.*—Public hearing procedures shall not inhibit free expression of views by requirements of more than one legible copy of any statement submitted, or for qualification of witnesses beyond that needed for identification.

(j) *Records.*—A record of public hearing proceedings shall be made promptly available to the public at cost.

Coordination and non-duplication

In accordance with the policy of section 101(f) of the Federal Water Pollution Control Act, public participation activities and materials required under the Act or these regulations may be combined with closely related programs or activities of the agencies concerned, wherever such combination will enhance the economy, the effectiveness, or the timeliness of the effort, enhance the clarity of the issue, and not be detrimental to participation by the widest possible public. Hearings and meetings may be held jointly by more than one agency on the same matter under the Act, where such procedure does not conflict with other provisions. Interstate agencies particularly are encouraged to develop combined proceedings on behalf of the States concerned.

Applicability

The provisions of this part shall apply only to actions taken after the effective date of this part.

IV.2 Implementation of citizen participation

John Goodman, Joseph Falkson, Barbara Mertens Lindsay Happel *

Citizen participation in environmental management has been viewed as a good idea by both municipal officials and planners. But, even though it is recognized that it would improve planners' responsiveness to community needs, participation has not always been encouraged or implemented for fear that it would create political conflict and delay projects. However, today's citizens are more articulate, more aware of their rights, and more sensitive to environmental issues. While most municipal projects could be built with no citizen involvement, the risk of expensive, time-consuming delays and court suits is increasing dramatically. Due to changes in citizen's attitudes and new federal regulations, implementation of citizen involvement is no longer simply a luxury or a "good thing to do." It is a necessity.

This paper will briefly outline sample requirements for participation, discuss the most prevalent mechanisms (e.g., public hearings, citizen advisory boards, and workshops) used to fulfill these requirements, and then will point out pitfalls to avoid in implementing these mechanisms.

Requirements for citizen involvement: legal

The following discussion of the legal requirements for participation in Water Quality Management is included to serve as an example of the requirements being attached to federal environmental funds.

Section 101(e) of the Federal Water Pollution Control Act Amendments of 1972 broadly stipulates that public participation shall be "provided for, encouraged and assisted by the EPA Administrator and States" in the "development, revision . . . of any . . . plan or program established by the EPA Administrator or State."

The proposed regulations to implement Section 101(e) very strongly emphasize the need for public participation early in the stages of policy formulation. They specifically state that:

> Conferring with the public after an agency decision has been made will not meet the requirements of this part. 40 CFR 105.2

This regulation states that substantive participation, not after-the-fact review, is required in the development of a plan or a federally funded municipal project. The guidelines also require that before any agency action is taken on a plan or program, such as approving a construction grant application, a "summary of public participation" must be submitted. Such a requirement, if strongly enforced, will insure that states include participation in all activities covered by the Act. The development of state strategies and waste treatment priority lists require public hearings to give the public a chance to comment on the priorities presented in the plans. The amendments also state that a citizen has standing to take court action against the Federal Government or any other authority in violation of the mandatory requirements of the Act. New York and several other states authorize environmental advisory boards at the municipal level. The very existence of these boards requires the municipal official to consider their input.

"(e) Public participation in the de-

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*Presented by John Goodman, Technical Assistance Research Programs (TARP), at the National Conference on Managing the Environment.

velopment, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator or any State under this Act shall be provided for, encouraged, and assisted by the Administrator and the States. The Administrator, in cooperation with the States, shall develop and publish regulations specifying minimum guidelines for public participation in such processes."

"Each summary of publc participation shall describe the measures taken by the agency to provide for, encourage, and assist public participation in relation to the matter; the public response to such measures; and the disposition of points raised." 40 CFR 105.15(d)

The 1972 Amendments also require a public hearing prior to the establishment of any effluent limitation standard. The Governor of a state or the State Water Pollution Control Agency must also from time to time hold public hearings for the purpose of reviewing applicable water quality standards (Section 307 of Federal Water Pollution Control Act Amendment). The new regulations implementing Section 303 of the Amendments stipulate that public participation "with adequate opportunity for public hearing upon proper showing" will be required for the proposed planning process. The regulations also state that:

> . . . plans will be officially adopted, after appropriate public hearings, as the official water quality management plans of the state and that the plan may be revised, after public hearings, as appropriate. 40 CFR 130.32

Practical requirements

There is a growing tendency for citizens to sue or to complain to the funding federal agency when they feel there is bad faith on the part of a city official. If citizens are dissatisfied with the way the environment is being managed, and they have no way to make substantive input to the process, they have only to find an infraction of the regulations to delay projects, and do great damage to the municipal budget. Federal grant regulations are complex, and it is difficult for an official to be in compliance with all regulations.

Citizen participation mechanisms

Any effective participation mechanism must allow for two elements: education of the citizens and the response of the planners and officials to the citizens. In order to insure intelligent, objective participation by the public, the public must understand the nature of the problem, all the possible solutions, and the costs of these solutions. The municipal official, on the other hand, must respond to the input of the citizens, and insure that their input will have an impact.

Three public participation mechanisms which can include these elements will be discussed here: public hearings, advisory boards, and workshops.

Public hearings, though most prevalent, are not necessarily the best means for participation. There is one major problem with hearings: the inability of citizens to be sure that they have had an impact on the planning process. Hearings allow little opportunity for constructive feedback from the hearing officer on whether the public's views have influenced him or not. If the public feels that they have had no impact through the hearing process, frustration builds. Such frustration may lead to civil suits, court injunctions, and delays in project implementation.

Citizen advisory boards are more acceptable because they allow two-way communication. The boards provide the municipal officials with a channel for dissemination of information to the community and also provide the public with the opportunity to convey its values and viewpoints to the planner. Boards are also useful in helping a municipal official anticipate public reactions.

Problems may arise, however, which can hinder the effectiveness of the boards. The board members may be unsure as to their function and/or may be inadequately prepared to evaluate technical information and offer substantive advice. City officials may find it impractical to heed the board's advice.

Many of the problems encountered with public hearings and advisory boards can be avoided, or at least decreased, if the city official realizes early the need for a mutually supportive, two-way relationship with the public. The third participation mechanism being discussed here, workshops, provides the framework for this two-way relationship, and should be utilized in conjunction with public hearings and advisory boards.

Workshops are excellent teaching mechanisms which allow timely and substantive input from citizens and planners alike. They provide interested citizens with the tools to make intelligent decisions and they provide planners with data and alternatives.

Public workshops

The workshops should be oriented to a particular project or issue. If the workshops are being utilized to encourage general participation, or to initiate a city-wide citizen advisory board, it is still advisable to plan them around a specific problem. This will provide all participants with "something to get their teeth into." It will also provide a model for holding future workshops, where solving a particular problem may be an imperative.

An advisable strategy for the workshops is to hold separate sessions for the citizens and city officials, in preparation for the two groups actually getting together.

For the citizens, the workshops should include the following:

(1) *The legal requirements for participation.* The implications of the law should be delineated in practical terms (e.g., what information is required to be provided, what participation mechanisms may be set up, etc.).

(2) *An examination of the process of the workshop subject.* This should include the administrative stages of the planning and implementation process, and a relatively non-technical discussion of the planning principles and technology being applied.

(3) *A discussion of the advantages and disadvantages of different citizen participation mechanisms.* Advisory boards, workshops, public hearings, as well as lobbying, lawsuits, and the concept of citizen advocates should be discussed. Practical operational problems of making input such as organizing citizen leadership, obtaining technical consultants, and timing actions appropriately need to be explained.

(4) *Utilization of case studies.* Case studies are recommended here in order to give citizens experience in evaluating alternatives and making group decisions. The case studies should concern different citizen actions, as well as different planning decisions related to the workshop subject.

Much of the information provided for the citizens should be provided for the planners and city officials, although from a different perspective. For instance, the practical delineation of the legal requirements for participation would include when and how the public should be notified of projects, what information should be provided, etc.

The planners should also be given:

(1) *Advice as to methods of implementing participation.* This would not only include mechanisms that may be utilized, but practical means of implementing them (e.g., who should be represented on a board, how these people should be selected, what role the board has, etc.).

(2) *Effective means of noitfication of citizens.* Early and wide-spread notification of the public of all plans and meetings is essential to the prevention of project delay. More publicity is needed than just

an item in the notices section of the newspaper.

(3) *Utilization of case studies.* Case studies for the planners should concentrate on successful and unsuccessful means of implementing participation. Planners should be shown what has happened in the past, and be given the tools to deal with similar problems that they may face.

Once the citizens and planners of officials have been given all the information they will need to work effectively with each other in the municipal environmental process, they should be brought together in order to formulate plans for on-going cooperation. Role playing might be utilized here, and the dynamics of group process illustrated through problem-solving exercises.

One fact which is not widely known is that the cost of workshops, like public hearings, is an allowable expense under federal construction and planning grant regulations. This means that seventy-five percent of the cost of a workshop connected with a specific project will be paid for by the Federal Government.

Points to remember

Whichever mechanism, or combination of mechanisms, you choose, there are several points that should be kept in mind. First, the citizen participation mechanism must not be merely a public relations effort. Citizens are now sophisticated enough to see through a sham. Experience has shown that if citizens do not feel that the established mechanism is serving a functional purpose, they will not hesitate to establish their own mechanism, whether it be picketing, organizing a separate citizen's group for lobby purposes, or going to court.

Citizens and municipal officials must have a clear understanding of their individual role in the mechanism. Conflicting expectations by the citizens and the planners can render the mechanism ineffective. For example, if the role of a board is simply defined as "to make input," citizens often assume they are to make policy. The planner, on the other hand, may assume that they are only to give advice. When this situation occurs, bad faith is charged and conflict develops. A recent sample of this occurred at the Columbia Point Health Center, in Boston. The Center Director felt that his advisory board had no decision-making authority. When he chose to ignore their input, the board and the citizens represented by the board became extremely frustrated. In this case, actual violence broke out.[1]

Finally, it must be remembered that timing is important in the implementation of citizen participation. The board must be consulted, the public hearing held, or the workshop must be run prior to the decisions being made. Timing makes the difference between active participation and after-the-fact review.

Effective participation, if properly implemented early in the planning process, will help reduce conflict and increase the longterm efficiency of your municipal process.

Notes for Paper 2

[1] See "Seige at Columbia Point," Time Magazine, October 30, 1972.

V: Strategies for Managing the Environment

In the past, when a government official was asked what his agency was doing to improve the quality of the environment, his response was nebulous at best. A federal or state official might have discussed his ineffective environmental quality standards, or pointed out that environmental problems were the responsibility of local governments. A local official might have pointed to collection and disposal methods of solid waste or to a sewage treatment plant.

If an environmental crisis, such as the severe pollution of a nearby stream, were to occur, governments had very few means of solving that immediate problem. Their alternative responses included: ignoring the problem and hoping that it would improve itself; if the source of the pollutant could be identified, talking to the polluters in the hope that they would improve the situation; if a nuisance did exist, threatening or initiating a legal action, and applying political pressure or economic sanction on the major polluter.

The ineffectiveness of the traditional approaches toward environmental management is realized when one looks at the multitude of environmental problems today. During the past few years, all levels of government have begun both to develop and test new strategies for environmental management and to modify the traditional strategies for today's problems.

Since the complexity of environmental management can be overwhelming, even to a knowledgeable observer, a rather simple framework is presented as an aid to understanding the involvement of government in environmental management. For example, the issue of controlled or restricted growth could be viewed from many perspectives, as a policy statement outlining some goals, a plan for action or an enforcing process. Although this framework, as presented in Figure 1, has some obvious weaknesses, such as drawing a sharp dichotomy between policy and action (ends and means), it does clarify the relationship and develop a typology of various environmental strategies. The framework identifies four basic categories of strategies for managing the environment:

Policy Goals, which are general statements outlining the overall improvement of environmental quality and the quality of life;

Strategic Objectives, which are specific poicy objectives such as limitations or controls on growth, restoration of the damaged environment, controls on the discharge of pollutants and controls on the use and misuse of natural resources;

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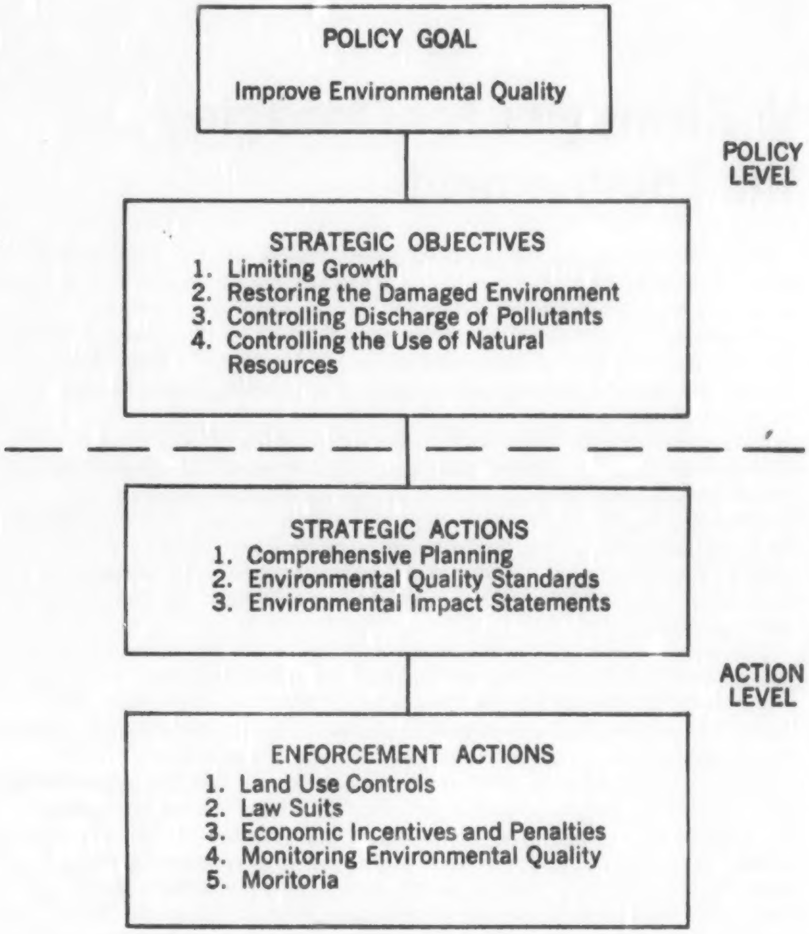
FIGURE 1.—STRATEGIES FOR MANAGING THE ENVIRONMENT: A CONCEPTUAL FRAMEWORK (1)


POLICY GOAL
Improve Environmental Quality
POLICY LEVEL
STRATEGIC OBJECTIVES
1. Limiting Growth
2. Restoring the Damaged Environment
3. Controlling Discharge of Pollutants
4. Controlling the Use of Natural Resources
STRATEGIC ACTIONS
1. Comprehensive Planning
2. Environmental Quality Standards
3. Environmental Impact Statements
ACTION LEVEL
ENFORCEMENT ACTIONS
1. Land Use Controls
2. Law Suits
3. Economic Incentives and Penalties
4. Monitoring Environmental Quality
5. Moritoria

Strategic Actions, which are broad actions such as comprehensive planning, assessment of environmental impact, and adoption of standards for environmental quality; and

Enforcement Actions, which are designed to compel compliance with the strategic objectives and actions such as land-use controls, law suits, economic incentives and penalties, moritoria, and monitoring environmental quality.

Three related factors which affect the development of environmental management strategies are: the current state of technical knowledge and research progress on the environment, the construction and modification of equipment and facilities, and the organizational arrangements for administering environmental management programs.

In using the framework, this paper focuses on new actions which are being taken by governments to improve the quality of the physical and social environment. The purposes here are: to provide a model for understanding the interrelationships between the adoption and implementation of policy and strategic environmental management actions taken by governmental bodies; to analyze the various ideas evolving out of papers and panel presentations at the National Conference for Managing the Environment; to identify and analyze innovative actions taken by local government, with the realization that many of these innovative actions, while appropriate in one setting, may need to be adapted to the needs and constraints of each new setting; and to analyze the modification of more traditional actions in environmental management which are being adapted for use in different problem areas.

NATURAL RESOURCES AS FINITE

In the past, the natural resources of the earth were viewed as being infinite. Man could consume as much of the resources as he needed without worrying about running out of resources. The inaccuracy of this assumption in today's world is demonstrated by the depletion of energy sources in the United States. Environmental managers have begun to view the earth as a closed system with limited amounts of resources. The stability of the ecosystem depends in large part upon its complexity. However, man has been turning fields into buildings, thus reducing the complexity of the earth's ecosystem and increasing the danger of a large-scale malfunction of the life support system. One only needs to look around to identify various visible breakdowns in the system.

MAN-NATURE SYMBIOSIS

Since his first days on earth, man has viewed nature as a hostile force with which he must contend. In order to survive, he thought that he must dominate it; have the right to control it to fulfill his needs for survival; and if necessary, exploit it without regard to the consequences. The disappearance of many wildlife species and the scars on the earth's surface left from strip mining are monuments to this falsehood. Environmental managers are realizing that man must learn to live as part of nature. Since man is living in an age of science, he may have to abandon some traditional values and some crude, destructive technologies which attempt to control nature. He is learning to regard nature with more respect so that his way of life and use of technology are more in harmony with nature.

NEW TECHNOLOGIES FOR NATURE

Since the linkage of science and technology during the middle of the nineteenth century, man has attempted to accumulate more and more technology without questioning either the ultimate goal or uses of technology or the consequences of its use. Technological development has become a goal rather than a means. Man cannot reject science and technology to retreat to a more primitive state. It has become a vital part of our civiliation. Since it would be impossible at this point to give up our present level of knowledge, the environmental managers must accept the consequences of our past uses of technology and realize that continued use of these old technologies may result in some form of eco-disaster.

Thus, new strategies for managing the environment are being developed, based upon the new set of assumptions. For example, new air and water environmental quality standards and enforcement processes are aimed at maintaining, and hopefully restoring, some stability in the ecosystem. The improved quality of polluting discharges has resulted in the revitalization of lakes and rivers previously considered dead. In addition, the assessment of environmental consequences of programs and projects is attempting to improve the relationship between man and nature, to reduce the likelihood of further elimination of some natural resources, and to limit technological ravaging of nature. Environmental managers are becoming guardians of the earth's resources.

ADOPTION OF ENVIRONMENTAL POLICY STATEMENT

One of the first steps taken by many local governments has been the adoption of a policy statement concerning environmental quality and outlining environmental management programs. Before we progress too far, it may be appropriate to clarify what a policy statement contains. In "The Study of Policy Content," Austin Ranney has identified five major components of any policy statement, including: a particular object or set of objects which are to be affected; a desired course of actions detailing a sequence of desired behaviors; selected lines of actions which delineate one course of action selected from many; a declaration of intent which is a statement of what policy makers intend to do; how, and why; and implementation of the intent. In the environmental policy area, like other policy areas, the adopted statements have emphasized different components. Some policy statements, in primarily addressing themselves to identifying the set of objects and a declaration of intent, formulate a general environmental goal. Yet, other policy statements, in detailing different courses of action, stress the development of strategic objectives for environmental management. It should be noted that there will be elements of both general goals and strategic objectives in any policy statement adopted by a governmental body.

GENERAL ENVIRONMENTAL GOALS

In recent years, many governmental bodies have developed and adopted a general environmental statement. Before going on, it is important to make the distinction between official policies and operating policies. In many cases, the official policies adopted by the legislative body may not be reflected in the day-to-day administration of environmental programs.

The federal government was one of the first to act when the National Environmental Policy Act (NEPA) was passed in 1969. The act outlines a national policy which encourages productive and enjoyable harmony between man and his environment, promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, and enriches the understanding of the ecological system and natural resources important to the nation. The intent of this general policy statement was to declare that:

> "It is continuing policy of the federal government, in cooperation with state and local governments, to use all practical means and measures including financial and technical assistance in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic and other requirements of present and future generations of America."

NEPA also pointed out the areas of federal responsibility for environmental management. The federal responsibilities include: (1) fulfillment of the responsibilities of each generation as a trustee of the environment for succeeding generations; (2) assuring that all Americans have safe, helpful, productive, esthetic and culturally pleasing surroundings; (3) attainment of the widest range of beneficial uses of the environment without degradation, risk to safety or health, or other undesirable and unintended consequences; (4) preservation of important historical, cultural, and natural aspects of our national heritage; (5) maintenance of an environment which supports diversity and a variety of choice; (6) achievement of a balance between population and resource use which permits high standards of living and a wide sharing of life's amenities; and, (7) enhancement of the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

KNOW YOUR ENVIRONMENTAL 'RIGHTS'

One of the more controversial aspects of NEPA was a statement in which each person was originally granted the right to a healthful environment. After considering the objections, Congress modified the act to reflect that each person should enjoy a healthful environment and has a responsibility to contribute to the preservation and enhancement of the environment. However, at least seven states have guaranteed to their citizens the right to clean air and water in the state constitution.

Thus, NEPA outlines a general policy which is to be used to guide environmental programs and actions of the federal government. It should be emphasized that many of the goals in NEPA are in disagreement with the goals of other legislation. For example, the environmental concerns as expressed in NEPA may be in conflict with some aspects of federal highway programs. Only through the implementation of various actions for managing the environment will the conflicts be resolved and the operating environmental policy be clarified.

At the local level many cities are adopting their own general environmental policy statements in the form of a "mini-NEPA" ordinance, resolution on the environment, or statement in the comprehensive plan. In a recent survey conducted by ICMA, it was found that just under twenty percent of the respondents had adopted some formal general environmental statement on policy and goals while fifty-seven percent had not. The remaining twenty-three percent are presently considering adoption of some form of general environmental goals. Furthermore, of the cities with a population of over 500,000, more than half have adopted environmental policies. It is not surprising that local governments followed the lead of the federal government with most of the environmental policy statements being adopted in 1971 and 1972.

A typical environmental policy at the local level is reflected in the statement adopted in November 1972 by Westminster, California. The environmental element of the comprehensive plan states that "the policy of the citizens and the government of Westminster is to enhance and maintain property to high esthetic standards, minimize adverse environmental impact of urbanization and industrialization, and eliminate deteriorating environmental situations or processes in order to achieve a community compatible to wholesome psychological, physiological and sociological growth."

STRATEGIC OBJECTIVES

A second type of policy statement which can be adopted by governmental agencies involves the adoption of a strategic objective for city operations. Generally, four major types of strategic objectives are commonly being adopted by local governments. They include the control and possible limitation of growth within a community, the control of pollution discharges into the natural environment, the prevention of further deterioration of natural resources and environmental quality, and the restoration of environmental quality in areas where pollution has taken its toll on the ecosystem. Since it is impossible to analyze all four strategic objectives, here the focus is on managing growth.

At a conference sponsored by the Rockefeler Brothers Fund on May 24, a task force chaired by Laurence Rockefeller reported on land use and urban growth. The group's policy statement calls for the abandonment of the deeply ingrained idea that private ownership of land carries with it the right to develop the land. After much study and analysis, they arrived at three major conclusions. First, the task force identified a new mood which is reflected in the public demand for no more "growth at any price." At the local level, that attitude has manifested itself in the establishment of a growth ceiling in Boca Raton, Florida, the land-use regulations along the coastline in California, and the purchase of land for greenbelt development in Boulder, Colorado. Second, the task force concluded that increases in population and the accompanying demand for new homes and housing and other forms of services will continue well into the twenty-first century. Those pressures will be compounded by the continued rise in family income and level and personal consumption. For many local governments who are presently using the maximum natural resources (e.g., present municipal use of available water), this means that some alternative strategy for managing growth must be developed in order to avoid disasters. Finally, the task force concluded that the success in reconciling political pressures for growth and the demands for a better quality environment will depend on guiding and restricting development without necessarily compensating owners for restrictive use and possible decrease in market value. They called for the development of new protective regulations regarding open space.

During the Conference's workshop on growth, Martin Johnson, Secretary of the Agency of Environmental Conservation of the State of Vermont, stated that growth must be limited for the good of everyone. However, before developing strategic objectives on growth limitation, the region's carrying capacity should be determined. In his paper, "The Concept of Carrying Capacity," found in the latter part of this chapter, A. Bruce Bishop, Assistant Professor of Civil and Environmental Engineering, Utah State University, defines carrying capacity in terms of biological or physical relationships between a given resource stock and its maximum sustained yield. A determination is made as to the maximum number of individuals of a species that can be supported by a given habitat under various conditions of stress. A common question asked is: what is the capacity of the reservoir and the river downstream to maintain natural water quality levels and continue the support of existing ecosystems? This is particularly important to local governments which are reaching the limits on their water supply. Other questions include: what will be the impact of air quality conditions with increased traffic and housing and commercial developments? What animals and plants will be displaced by further development of open space? The carrying capacity is a concept that has a rather long history in resource management, particularly as it relates to the limiting of livestock according to available food supply and water. In concluding, Mr. Bishop points out that the similarities among natural ecological systems suggest the use of a new broader method of describing resources of the human environment for environmental management.

CREATING AN ENVIRONMENTAL DATA BASE

In conjunction with the research on the carrying capacity of a region, it may be important to conduct an environmental resources inventory analysis. Roger Hanson, Executive Director of The Rocky Mountain Center on the Environment, suggests that environmental managers must have a valid environmental data base as a starting point for the development for any growth policy. This inventory would identify and locate of the major elements of the ecosystem including climate, geology landforms, surface water, botanical biomes, wildlife species and historical and cultural landmarks and current land-use patterns. In the long run, this data could be used as a basis for enforcement that is scientifically and legally defensible.

According to Martin Johnson, once the data is developed environmental managers can proceed with a three-step plan. First, social goals need to be developed and defined including the opportunity for health, happiness, education, recreation, and diversity of experience. Second, in developing a plan for achieving the goal, a comprehensive approach must be taken considering the availability of resources in the region and the state of the environment. This plan could be incorporated in the environmental section of the comprehensive land use plan and should include settlement patterns, transportation patterns networks, economic base, energy requirements, natural resources, recreation facilities, etc. Finally, enforcing or policing powers must be developed to regulate the implementation of this strategic objective.

In developing either a general environmental policy statement or strategic objectives, environmental managers must keep in mind, or avoid displacing, these goals through an overcommitment to specific environmental actions. In other words, they must keep in mind the overall goals and objectives of the environmental policy when developing and implementing various actions such as environmental impact statements, development of standards, land-use controls, and legal actions. Besides this warning, there are two potential problematic consequences which should be mentioned. First, environmental decision-makers may believe strategic actions alone will be sufficient and that no further action, strategy or enforcement is necessary. In many ways, it is easier in the political arena to adopt a general policy statement and strategic objective without developing the necessary enforcing actions. A second problem relates to the adoption of various enforcing actions without a policy framework which can serve to provide direction and to integrate the various types of actions into a coherent plan for managing the environment. With these environmental policies in mind, we now can turn to specific actions that local governments can take to manage the environment.

ACTIONS FOR ENVIRONMENTAL MANAGEMENT

After a policy statement is adopted, or in some cases before, there is a need for developing specific actions which will promote the achievement of these goals and objectives. First is the need for strategic actions which involve the development of programs for improving environmental quality without enforcing procedures. Examples of such actions are a cost-benefit analysis of the environmental impact statements, the development of a comprehensive land-use plan which outlines the direction for promoting environmental quality, and the development of environmental quality standards. To regulate and promote the strategic objectives and actions, enforcing actions are required. They include such things as economic incentives and penalties, legal action, land-use controls through zoning, subdivisions and purchases of lands for greenbelts, monitoring, and other related regulatory processes.

Comprehensive Planning—One of the more traditional strategic actions is comprehensive land-use planning. This involves the development of an environmental section in the land-use plan which outlines the land-use patterns, human environmental perspective, inventory of the natural resources within the community, and future planned development which would minimize environmental damage.

Edward J. Kaiser and others point out that the redefinition and reorganization of comprehensive planning to reflect environmental objectives is being accomplished through two means. First, many local governments are adding a new section to the total planning program, focusing on the environment and paralleling it to other sectors in economic development, social policy and transportation. Los Angeles added a new segment to the general plan with the purpose of (1) serving as a comprehensive guide for the various governmental and public agencies to identify the interrelationships between the various aspects or dimensions of environmental problems, (2) providing a specific policy recommendation needed for the formulation of standards and legislation relating to environmental quality, (3) presenting guidelines for modifying city procedures in order to minimize negative impact of city operation on the environment, and (4) a comprehensive data source pertaining to environmental factors.

Environmental Impact Statement—A second strategic action which governments can take is the development of a process for assessing the potential impact of projects and programs. This assement process has taken a number of forms from benefit-cost analyses of various alternatives according to their potential environmental damage to impact assessment reports which summarize economic, social and physical consequences of a particular development.

IMPLEMENTING ENVIRONMENTAL IMPACT STATEMENT PROCESSES

As a result of NEPA the federal government has assumed a leading role in defining and developing environmental impact statement processes. In the last few years, the process for developing and writing impact statements has undergone several sets of guidelines; in fact, the Council on Environmental Quality (CEQ) is now in the process of finalizing a new set of guidelines. Lyle Sumek summarizes some of the major problems in implementing environmental impact statement processes: (1) implementation has been inconsistent with lengthy statements on minor projects and no statements on major programs; (2) the financial costs of conducting the assessment have not been adequately covered; (3) authors of impact statements lack technical expertise; (4) the lengthy period for preparing and writing the statements has resulted in delays and the discouragement of applicants; and (5) the procedure for meeting NEPA requirements has taken precedent over the substantive content of impact statements.

In 1970, California passed an Environmental Quality Act which directs all local governments to make environmental impact reports on any project they intend to carry out and which may have significant environmental effect. In clarifying some confusing points, the California Supreme Court ruled in *Friends of Mammoth* v. *Board of Supervisors* of Mono County that impact assessment reports were required for all public and private projects in cases where local government could be denied approval. The immediate decision of many local governments was to place moritoria on building permits and rezoning.

One of the first cities to develop an impact statement process was Inglewood, California. City Manager Douglas Ayres, in describing his city's approach to environmental impact statements during the Conference workshop on Comprehensive Planning, said:

> "It seems to us that the analysis of an environmental impact from the physical standpoint, such as that done by many jurisdictions, was simply inadequate since our particular jurisdiction is in a metropolitan area of some ten million people and has only 93,000 population right in the middle of it. Our control over air, water and solid waste pollution was really pretty much geographically limited as to the way we could control it. Subsequently we developed a review of those subjects on which we could have an impact and called it Total Impact Analysis."

The objectives of the analysis are to focus attention on existing environmental problems and solutions, to integrate environmental concerns of the community, to broaden the scope of environmental concerns, to improve the public decision-making process as it affects the community and to involve community participants in contributing to environmental improvement. In an attempt to assess both positive and negative effects of a particular project, Inglewood developed the impact rating and quantification sheet which lists environmental, social, economic variables which might be affected. In each case, every variable is assigned two numbers: (1) one value reflects the amount (severity) of the impact and (2) another reflects the relative importance of this impact unit as compared to the others. Professional judgment, questionnaires and some forms of group decision-making are used to determine appropriate values. Then, these two quantities are multiplied, resulting in impact unit totals for each variable. Next, a dollar value is assigned to each impact unit and this is multiplied by the previous figure to arrive at an estimate of the net social costs and benefits. The comparison of costs and benefits would enable the decision maker to judge the desirability of a project. Thus far, three environmental impact studies have been completed: (1) a sewage site for a water treatment plant, (2) the construction and operating of the plant, and (3) a study of an alternative freeway route. Mr. Ayres admitted that the process was more a way of demonstrating the coordination of effects and programs to various departmental officials than a substantive assessment of environmental impact.

AN IMPACT STATEMENT ON COMPREHENSIVE PLANS?

During the same workshop, Robert Einsweiler, a planning consultant formerly with the Metropolitan Council for Twin Cities, posed the question: Why not an impact statement on comprehensive plans? He pointed out that the project-oriented impact statement process is a weak one, hampered by a log-jam of statements, posing delays near the action phase of a project, focusing on a limited effect with limited consideration of secondary consequences, not linked to planning and program budgeting, and containing inadequate treatment or recognition of alternatives. While focusing on a single project, impact statements may be asked to cover the full range of issues surrounding a general policy. While not offering a solution, Mr. Eisweiler pointed out some of the benefits that could arise from having an impact statement on a comprehensive general plan. These benefits include the following: (1) the elevation of the status of land-use planning in public decision-making, (2) the introduction of greater environmental sensitivity into planning agencies, (3) the elevation of some issues to city-wide, regional, or state issues (i.e., the urban land use of prime agricultural land in Minnesota), and (4) the familiarity of planners with the objectives of impact assessment, since they are more acquainted with trade-off analysis than are the functional agencies responsible for the program. In supplementing Mr. Einsweiler's list, one could add that a less biased assessment would be performed by the planning agency, resulting in less program justification and more appraisal of environmental consequences. Also, a wider range of issues and alternatives may be generated by looking at more policy issues and variables than the ones currently being assessed. The impact statement on comprehensive plans is not without its faults since it would lengthen the planning process.

If an impact statement is written on a comprehensive plan, there may be no need to write impact statements on each individual project or program if it falls in line with the comprehensive plan. However, for projects falling outside or modifying the comprehensive plan, then an impact assessment could be made. This might result in less need for staff, less need for funding for environmental impact statement writing and reviewing. Ultimately, it might lead to a smoother process, one not plagued by delays.

Environmental Quality Standards—A final strategic action which can be used by governments is the development of standards for the quality of the environment. In addressing the issue of standards, an immediate question becomes: who has the authority for developing the environmental standards? During the workshop on "Standards of the Environment," Mr. William Blaser, former director of the Illinois Environmental Protection Agency, pointed out that the issue of environmental standards requires joint responsibility, particularly between state and local governments, in order to avoid the confusion and possible conflict due to many levels of government being involved in the process. He suggested that one improvement could be made in management systems by the adoption of an identical standard.

FIXED VERSUS VARIABLE QUALITY STANDARDS

In analyzing the issue of fixed versus variable environmental standards, Robert Pikul of Mitre Corporation argued for variable environmental standards. The major objections to variable standards are that they can result in inequitable treatment of sources; for if your discharge into the environment is being controlled more stringently than a neighbor's, theoretically you will have a higher cost and must be hampered in the marketplace. While this is a vital concern, Mr. Pikul pointed out that the concept of equity ought to be brought into view (more broadly including externalities)—cost of environmental damage. A second objection to variable standards is the complexity in administrative costs. Although it may be true that fixed standards are less costly to administer and enforce, it should be pointed out that the benefits of a variable standards are greater. Environmental managers would be able to adapt the standard for environmental problems in a particular ecosystem. A third objection is the effect on the national economy. Mr. Pikul pointed out that, if motor vehicle emissions standards vary from state to state, this would require the manufacturer to adopt a variety of control devices to meet the different standards. It would also affect every citizen if he drove from one state to another.

In a proposal to achieve ambient standards for oxidants in southern California, Mr. Pikul pointed out some immediate social and economic impacts of variable environmental standards: (1) increased cost to automobile owners of two hundred to four hundred dollars in initial capital and five to fifteen dollars annual maintenance, (2) increased reliance on carpooling and transit, (3) reduced mobility, (4) a potential cost of income due to decreased mobility, (5) economic curtailment of automotive service and supply facilities, (6) changes in property value, (7) reduced taxes, and (8) potential development of effective rapid transit. The acceptance of variable standards in different geographic locations may also allow people to make a choice regarding where they want to live based upon the risk they want to associate with deteriorating air quality. Mr. Pikul concluded that more analysis is needed before any decision is made.

In developing environmental quality standards, many factors have to be considered: political, economic, and social. But once the standards are developed, then enforcing techniques are needed to assure the compliance with the environmental quality standards as outlined in various public policies of a strategic objective, where a governmental body adopts a policy concerning a specific objective. In developing these standards, Mr. Blaser pointed out the great importance of "people standards." He suggested that people standards are as important as scientifically developed standards since environmental managers must not only look at the chemistry, but also at the sociological and psychological dimensions of the environmental problem.

In interpreting the Clean Air Act of 1970, the Supreme Court ruled that states must maintain air quality at least equal to present level, even if deteriorated quality would still meet federal standards. In a deadlocked four-to-four vote, the Court endorsed the decision by the Federal District Court for the District of Columbia, which was based in part on a policy of nondegradation of existing clean air and that Congress intended to maintain or lower air pollution levels. The federal government had argued that such strict controls would discourage economic expansion into areas of clean air and possibly inhibit population expansion into previously unoccupied lands. The immediate effect has been to prohibit EPA from approving any state air quality plan that would allow air quality to deteriorate. Prior to the decision, EPA had disapproved all pending state plans since none included assurances that the present quality of the air would be maintained.

ENFORCEMENT ACTION FOR ENVIRONMENTAL MANAGERS

Once strategic actions are adopted, environmental managers need to have processes and procedures for enforcing or directing compliance. For example, it is not sufficient to develop and adopt environmental quality standards without some means for making sure potential violations are avoided. These enforcement actions can be in the form of direct regulations in which a particular pattern of behavior deemed as being undesirable is prohibited, with violators facing some direct sanction. Good examples of this type of enforcing action would be criminal prosecution, monitoring, and land-use regulation. Indirect enforcement actions include government monitoring of the discharge of potential polluters, in the hope that monitoring by itself will be sufficient to force compliance.

Land-Use Controls—One of the oldest enforcing actions is land-use control. During his presentation, Roger Hanson, Executive Director of the Rocky Mountain Center on the Environment, pointed to the ineffectiveness of traditional land-use controls. He stated that irresponsibility in land-use practices due to ineffective land-use controls is the basic environmental problem facing the United States. To understand the ineffectiveness of traditional land-use controls, environmental managers need to have some appreciation of their historical development.

THE HISTORY OF LAND-USE CONTROLS

As early as 451 B.C., the Roman Codes stated whoever sets a hedge around his land shall not exceed the boundaries; in the case of a wall, he shall leave one foot, in the case of a house, two feet. During the thirteenth century in England the statute of Winchester commanded land-owning lords to cut any tree or bush which came within two hundred feet of a highway, so that evil doers could not lurk there. In the United States during the nineteenth century, Massachusetts adopted several land-use controls on types of buildings and on the industrial siting.

In terms of traditional land-use controls, Mr. Hanson identifies three major types of controls: private, legislative, and governmental agency. Private controls involve the unrestricted transfer of a fee for a purpose, conditional fees, trust agreements, easements for scenic and conservation purposes, and restrictive covenants. Their use may be the only effective control in many subdivisions and private developments. Mr. Hanson points out that these controlling devices use little imagination and have minimal flexibility.

The second type of traditional land-use control is legislative action, which is generally based on police power regulations such as laws concerning heath, welfare, and morals. The police powers in land regulation are realized particularly in zoning, subdivision regulations, building codes, plumbing codes, electrical codes, and other codes. He points out that they have frequently failed because of: (1) an inherent apathy to the dedication of land use without compensation, (2) the unfeasibility of enforcement because of local politics, and (3) conflicts between developers' plans and the comprehensive plan. Enabling legislation inhibits development of new planning ideas. His final point is reinforced by the fact that Colorado made planned-unit development illegal in thirty counties.

A final type of traditional land-use control is control by governmental agencies. Since one-third of all land in the United States is federally owned, various administrative agencies at the federal level find it very easy to control the development and use of those lands. Government ownership of streets, parks, forests, recreation areas and Indian Reservations allows for controlling their use and development. In addition, the use of eminent domain (taking land for public purposes with compensation), is usually used for highways, but rarely for parks, wildlife refuges, and other environmental programs. Urban renewal applies only to particularized local urban areas, generally those where a severe blighted condition exists. The health boards or pollution control agencies operate through the use of variants rather than strict compliance to any strategic objective.

IMPLICATIONS OF THE RAMAPO APPROACH

Only recently, local governments have begun to develop new land-use control mechanisms such as the requirement of large lots (forty acres) and the establishment of growth-limitation permits. The legality of some of these new controls is presently being tested in the courts. For example, Ramapo, New York, amended its zoning ordinance to create a new special permit labeled the Residential Development Use. Anyone wanting to use the land for residential development needed a special permit. It was granted only when standards were met for the new development. The new ordinance was vigorously attacked by land owners who claimed a destructive value on the marketability of their property. In addition, this new ordinance was a marked departure from the traditional development of the city which thought that private investing comes first. This case ended up in the New York Supreme Court where the Ramapo ordinance was upheld. All judges agreed that they were in opposition to using zoning ordinances for exclusionary purposes and that there was a positive role for the state in land-use matters. However, the majority opinion pointed out that there is an antiquated notion that regulation of land-use development is uniquely a function of local government. Ramapo, in acting on its own, developed reasonable procedures for appeals and variances which would show developers how to plan for phased growth. The court decision in effect told the state legislature to provide new approaches to guiding land development and to become an active participant in land-use controls.

In his presentation Mr. Hanson pointed out that states are beginning to realize the importance of their role and to impose some forms of land-use controls. He cited several examples: (1) Colorado and Oregon have adopted stringent requirements for local subdivision regulations; (2) states are acquiring authority over land use, such as Maryland's control of the siting of industrial facilities and California's, Maine's, and Delaware's controlling land use in the coastal zone; (3) the pre-emption of local governments to act in coastlines has evolved in Georgia, Michigan and Wisconsin; (4) Hawaii has adopted a two-tiered zone system; zoning by state of all lands into urban, rural, agricultural and conservation categories with local zoning involving commercial and light industry within gross state areas; (5) New York and New Mexico have tied capital expenditures such as airports and water facilities to land-use planning; (6) Vermont has adopted a system of regional bodies controlled by the state with the responsibility of making major land-use decisions; and (7) New Mexico and Vermont have established regional planning commissions and a state commission with veto power over land-use decisions. Mr. Hanson concluded that it is clear that state governments are giving up on the ability of local governments to make and enforce sound land-use decisions.

At present, numerous new strategies for land-use control are emerging. The foundation for these new mechanisms is the development of some form of environmental inventory which identifies and analyzes critical environmental factors. The resulting information will provide a scientific and legally defensible data base for future land-use controls. Mr. Hanson outlined a system of environmental resource inventory analysis. The system identifies and analyzes major elements of the ecosystem such as climate, geology, land form, surface, water, botanical and zoological life, and historical, cultural and present land use. This anaysis provides an in-depth systematic look at the current status of the environment.

INNOVATIVE APPROACHES TO CONTROLLING LAND USES

Since it would be impossible to identify all major innovations in land-use control, Mr. Hanson listed the following; the first innovation would be the development of state-wide zoning which classifies land into zones on a state-wide basis. This provides a broad view of land use which takes zoning out of the local political environment, where controls have been fairly weak and ineffective. A second new action would be the development of federal land-use commissions which would identify "federal land-use decisions." They would provide grant-in-aid programs to improve land-use planning and management at the state level, and be able to force states to inventory land-use resources and develop a state-wide land-use plan. The third innovation would be a program of public education indicating land-use patterns as a major source of our environmental problems. It would involve educating the public that land-use controls are profitable and that greater stability, greater efficiency, and less taxes would result. Another innovation would be class action suits in which an individual would be permitted to go to court opposing governmental and other decisions on land use in an attempt to show personal injuries. A fifth action would involve the licensing of realtors and subdividers, registration of subdivisions, and public disclosure statements which would require that a subdivider consider a broad view of the impact of his subdivision on the environment.

A major function of state and local governments is the development of a planning process to prevent the impairment of the environmental quality. Land-use controls can be an effective means in the fulfillment of this function. These controls can be used to enforce environmental quality standards, growth limitations, and comprehensive planning.

LEGAL ACTIONS REQUIRE LAWS

Legal Action—A second enforcement action is legal suits. Before legal actions can be initiated, a sound body of environmental laws and regulations must exist. Over the last thirty years, legal requirements have developed tremendously as evidenced in air pollution which has progressed from smoke codes to sophisticated emission standards. The focal point has shifted away from early state and local laws based on the states' police power to the assumption of greater responsibility by the federal government. Federal laws such as NEPA, the 1970 Clean Air Act, and the 1972 amendments to the Water Pollution Control Act provide the necessary frameworks for legal action.

However, the passage of these environmental laws does not mean that the programs will be properly administered or effective. Joseph Sax states that:

> "It may seem ironic that courts are needed to help make the legislative process work effectively; that citizens must come to the least democratic of the branches of government to make democracy work. But that is one of the intriguing questions now being explored under the label of environmental litigation."

During the workshop on legal action, Frank Grad of the School of Law, Columbia University, elaborated on this point when he commented that the law and legal developments in environmental protection have only gone as far as our governmental willingness to enforce them. He claimed that legal action has been a major generating force in strengthening both strategic and enforcement actions.

Athough there are many issues related to legal action, two major ones emerged from the workshop. The first issue is the "standing doctrine." In the past, the court has been reluctant to allow members of the public to sue since there was a fear that this would result in a plethora of crank suits. Although cases like the *Sierra Club v. Morton* have resolved standing, Mr. Grad pointed out that the Water Pollution Control Act gives only those with an "interest" the right to intervene rather than "any citizen," as under the Clean Air Act of 1970. Another aspect of standing is to confer rights to some new entity such as "nature." In the United States, legal institutions are generally resistant to giving things "rights" until they can be shown to have a value for themselves, as demonstrated by the lengthy period of time it took for the southern slave to obtain his rights. In a recent article Christopher Stone argues that:

> ". . . the environment should have rights is not to say that it should have every right we can imagine, or even the same body of rights as human beings have. Nor is it to say that everything in the environment should have the same rights as every other thing in the environment." [5]

In analyzing the legal dimensions, Mr. Stone argued that courts should be compelled to show how environmental damage was calculated and how heavily it was weighed. Two positive consequences would result: (1) it would shift the focus of courtroom testimony and concern; and (2) the appellate courts through their review and reversal of insignificant findings would build up a body of environmental rights. He pointed out that the Supreme Court may find itself in the position to award rights in a way that will contribute to a change of popular consensus. It would be a move that would further develop environmental strategic objectives and actions.

STATES AS ENVIRONMENTAL POLICEMEN

A second issue is the use of police power. In his presentation, Henry Lord, Deputy Attorney General, State of Maryland, argued that the states are well-equipped to deal with environmental problems. As the federal government has increased its involvement in environmental management, the police power of the states has been questioned. He pointed out that the Supreme Court in *American Waterways Operators v. Askew* has recently recognized, in a unanimous decision, this problem and resolved it in a way that gives state officials wide powers to protect natural resources in which they hold in trust for the citizens. He also argued that state interests take precedence over local interests, since states are better at balancing the interjurisdictional environmental costs and benefits. He cited the wetland as an area where the counties saw its value in terms of dredging and filling and not of conservation or preservation of natural resources.

During the past few years, particularly since NEPA's enactment, the volume of city-initiated suits in the courts has increased rapidly. These suits have attempted to open decision making to citizen input and to force compliance to laws and administrative regulations. Since the topic of citizen suits has been addressed in an earlier chapter on citizen participation, the topic will not be repeated. However, the developmnt of public interest law firms such as the Environmental Defense Fund (EDF) and the Natural Resources Defense Council should be discussed. In initiating many suits during the past few years, they have come to play a leading role in determining and clarifying environmental law. Mr. John Dienelt of the Environmental Defense Fund described the goal of the Fund as being to insure that the environment is considered in administrative policy decision-making. They have a staff of scientists which review every case before it is taken into court, to determine the technical correctness of their information. The EDF sees litigation as a means to an end in which there is co-equal participation in public governmental policy-making and decision-making, particularly in the area of the environment. The firm's effectiveness in legal action is demonstrated in the development of the federal environmental impact statement process through the Calvert Cliffs and Kaber decisions. Their desire is to decrease the use of legal action as administrative organizations become more and more responsive to environmental needs and desires.

PRIVATE CORPORATIONS AND ENVIRONMENTAL LAW

Since industry has become a common defendant in environmental law suits, private corporations have become active in environmental law. In discussing their development, Everett H. Bellows, Vice President of the Olin Company, states that corporations need to mobilize their total resources to deal constructively with environmental issues. He points out that the Olin Company's environmental resource council was organized to provide coordination within the company and with the sponsors of conferences for middle management. He concludes that industry has an obligation to appeal unfair environmental decisions. They may go to court to resist arbitrary and uninformed judgments, and to prevent such judgments from being translated into environmental standards and regulations that could not be enforced because of technological limitations or environmental costs.

Since heavy caseloads in the courts have resulted in lengthy delays, many cities are in the process of developing their own procedures. During the workshop on legal action, Norman Redlich, Corporation Counsel, New York City, pointed out that the city attempted to take two procedures to supplement normal legal action:

First, they have created an environmental control board which attempts to take many cases out of the court system and place them under the jurisdiction of administrative agencies. This board has been granted authority to issue cease-and-desist orders, revoke operating permits, and impose civil penalties of up to $100 a day for each violation. The city is working for state legislation to absolve the court proceedings and judgments and to grant judicial review only in cases in which the imposed penalty was arbitrary or capricious.

A second technique developed in New York City is the citizen complaint technique, where citizens are encouraged to file a complaint with the environmental control boards, alleging code violations. The Environmental Protection Agency then has the option to prosecute. If this initiative is not taken by the agency, the citizen then can prosecute on his own through the courts. A sliding bounty system was initiated in which a percentage of recovery fees was granted to the reporting citizen. An even higher percentage was granted if the citizen went to court after an agency rejection.

Thus, legal actions have become extremely important in the enforcement of strategic environmental objectives. In addition, the development and effective administration of other enforcement actions, such as land-use controls and moratoria, have to depend to a degree on clarification and interpretation in the courts. It is important to realize that the resolution of legal issues may determine the evaluation of environmental management.

THE POWER OF THE PURSE: INCENTIVES AND PENALTIES

Economic Incentives and Penalties—A third enforcing action is the use of various incentives and penalties in residual management. Although this topic was not directly addressed at the Conference, various examples such as the tap charges for connecting water and sewer lines, or the sewage discharge surcharge were discussed in several workshops.

Traditionally, environmental enforcement programs have employed economic incentives which are designed to incite action. For example, the Federal Water Pollution Control Act of 1965 financially supported municipal wastewater treatment plants, through the authorization of $3.4 billion for such grants. Industry has also received funds for the improvement of pollution control equipment and tax write-offs for the adoption of environmental programs. However, economic incentives are ineffective in bringing the social and environmental costs of production into pricing and curtailing the inefficient use of natural resources. In addition, subsidies for the construction of sewage treatment plants do not by themselves provide an incentive to take action for control of waste discharges. Even if government and industry were to pay a major portion of the cost of the waste treatment plant, it is cheaper from their point of view to dump the untreated waste into the river. Thus, subsidies cannot work under this type of arrangement unless they are accompanied by some other enforcing action.

EFFLUENT CHARGES AND OTHER OPTIONS

As an alternative to incentives, effluent charges are based on the assumption that since the environment is common property, any person or organization causing environmental damages must pay. These payments are based on the amount and content of the waste discharged. Hopefully, the charge would be sufficient to force improvement in the quality of the discharge. In addition, effluent charges are presently being defined by many governments in terms of sewage surcharges and penalty fees. Allen Kneese outlines a national water pollution program based on an integrative water quality plan and the development of a charge system. He points out that the strengths of an effluent charge are: (1) the final price of a product reflects the producer's cost of treating his waste and results in products from polluting activities being more expensive in the marketplace, (2) to reduce production costs, the producer adopts new production mechanisms and technologies for waste treatment, and (3) the effluent charge increases tax revenues.

Although the potentiality of effluent charge as an effective enforcement action is high, the feasibility of widespread development is low. The industries' opposition stems from their feeling that the charge is a punitive action and that it is unfair for them to pay for the residuals from waste discharges. They also argue that funds expended for charge payments could go into new pollution abatement equipment or research. Industry realizes that this charge is nearly unavoidable and unevadable.

From a different perspective, some environmental groups label the effluent charge a "license to pollute" since there is no total prohibition of all discharges. More sophisticated monitoring devices need to be developed to make accurate measurements of the quality and quantity of the discharge.

Other Enforcement Actions—Two additional enforcement actions which have been used by environmental managers need to be mentioned. First, enforcement conferences have been widely used in federal water pollution control programs. These conferences are presently called by the Administrator of EPA to bring all interested parties together in order to discuss and develop potential solutions to environmental problems. The government must rely on the participants for all information regarding alternative actions. Although cases may ultimately end up in the courts, the effectiveness of enforcement conferences has been plagued by delays and an unwillingness to convene such meetings. A second action is the use of moratoria by local governments. The adoption of moratoria on land development and rezonings is common in growth control. The legality of this action has varied from case to case.

CONCLUSION

This chapter has attempted to provide some framework for understanding the complex relationship between environmental policies and the differing programs and techniques for their implementation. The "state of the art" in environmental management is in an embryonic state, with new actions being developed and tested in a variety of environmental contexts. No single environmental policy or specific action is going to work in all environments. Political, social, and economic factors along with insufficient ecological knowledge will limit their effectiveness. In order to avoid working at cross purposes, environmental managers need to develop a comprehensive environmental policy along with a plan for implementation which integrates the various actions.

Notes for Chapter V

[1] For a detailed discussion, see Lyle J. Sumek, "A Conceptual Model for Environmental Management," an unpublished paper. The paper can be obtained through the Graduate School of Public Affairs, University of Colorado.

[2] Austin Ranney (ed.), *Political Science and Public Policy*, Chicago: Markham Publishing Company, 1968.

[3] See Steve Carter, Murray Frost, and Lyle Sumek, *Environmental Management and*

Local Government: Problems and Perceptions. A report conducted under the Environmental Studies Division and prepared for the Office of Research and Development, U.S. Environmental Protection Agency, 1973.

[illegible] *The Use of Land: A Citizen's Policy Guide to Urban Growth,* New York: Crowell, 1973.

[illegible] Christopher D. Stone, "Should Trees Have Standing?—Toward Legal Rights for Natural Objects," *Southern California Law Review* XLV (Spring 1972), pp. 457-8.

V.1 The concept of carrying capacity

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The capacity of natural and human environments to accommodate or absorb change without experiencing conditions of instability and attendant degradation is a significant concern in view of current trends of urban growth and development. The ability of the environment to sustain particular levels of activity may already have been exceeded in some areas and, in others, resource management options are rapidly being foreclosed. In the face of these changing conditions, a phrase heard more and more frequently is carrying capacity. As a developing concept for regional environmental management, this paper examines carrying capacity as an approach to understanding and analyzing the ability of the environment to absorb or support activities of urban and regional growth.

Accommodating Future Growth

Virtually every urban center faces problems of accommodating some degree of future development. In managing the environment for quality regional growth, questions related to the carrying capacity of environmental resources lie at the heart of the problem. Two brief examples from the Wasatch Front area of Northern Utah serve as good illustrations.

The Ogden Valley, situated five miles east of Ogden, Utah, is basically a rural agricultural valley of roughly fifty square miles, with a total population of about 1,000, residing in three small communities. The canyon is an important recreation resource offering excellent fishing and camping by the river which flows from the valley watershed and the Pine View Reservoir. The Ogden Valley offers extensive recreation opportunities for residents of the urbanized Ogden and Salt Lake City regions. The reservoir is a major water-based recreational area offering swimming, boating, and fishing. In addition, golfing, picnicking and camping facilities have been developed in the Valley, and two major ski areas on the mountain slopes serve the winter recreationists. Upland and mountain wildlife species abound in the Valley and the surrounding mountain forest areas. There are a number of proposals for large developments in the Ogden Valley and lower mountain slopes, including vacation resorts, condominiums, lower density summer home developments, and housing tract developments for bedroom communities for the urban areas. The Highway Department is considering plans for major improvements in access to the Valley. In the face of the mounting pressure for development, without a comprehensive analysis of the carrying capacity of the Valley, there may be serious and irreversible damage to environmental resources.

Key carrying-capacity issues

Some of the issues related to carrying capacity are:

- —What is the capacity of the reservoir and the river downstream to maintain the natural water quality levels and continue to support existing ecosystems?
- —What is the capacity of soil to resist erosion from intensive recreation or development use?
- —What is the capacity of the valley to provide infrastructure for development — water supplies,

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wastewater disposal, solid-waste disposal areas?

—What capacity constraints are imposed by the existing transportation system? What will be the effects of the increased capacity of the proposed high-speed access?

—What will be the impact of air quality conditions with increased traffic and housing and commercial development?

—What plant and animal species will be displaced, and what is the capacity of the ecological systems to absorb changes from development?

—What is the capacity of the Valley to serve as an open space and recreation resource?

The canyons immediately above the Salt Lake City are also being subjected to intense pressure for development. These canyon watersheds supply most of the water needs for the Salt Lake Valley. They also provide an outstanding recreational resource for winter skiing and summer mountain-outings and vacations. Large resorts have already developed in the canyons to serve recreation interests with proposals for many new resort hotel and private summer home developments. Questions relating growth and carrying capacity are:

—What is the capacity of the fragile watershed ecosystems to support various intensities of development and recreation use?

—What is the capacity of air and water resource systems to absorb the pollutants from these developments?

—Can a transportation system of adequate capacity for the development be constructed without complete disruption of the canyon ecosystem?

—What user-capacity can the recreational areas accommodate and still provide a satisfactory experience?

These examples illustrate the need for technical knowledge about the capacity of the environment to accommodate growth.

The carrying capacity concept implies understanding the regional environment as a support system for numerous, interdependent and competing activities and systems, and determining the limiting conditions and capabilites of the regonal environment to absorb, withstand, support, or sustain these activities without causing unacceptable changes in environmental quality.

Defining carring capacity

From the standpoint of ecosystem management, the term "carrying capacity" is used in terms of the biological given resource "stock" and its maximum sustained "yield." Specifically, it is interpreted as the maximum number of individuals of a species that can be supported by a given habitat under various conditions of stress. The general implied goal is to maximize the productivity of the system, subject to the constraint of non-impairment or non-degradation of the supporting ecological system.

In this context, carrying capacity is a working concept with a long history in resource management. In the management of range-land resources, the concept is inherent in the limitation of livestock numbers according to available forage and water. A range-land is said to be stocked at its carrying capacity when a given number of animals with known daily nutritional and water requirements is in equilibrium with or does not exceed the actual land productivity or forage and water on a sustained yield basis. The consequence of exceeding carrying capacity is a downward trend in range conditions. In forest resource management, the concept is applied in terms of harvesting only the net annual increase in board-feet of timber produced on the forest on a sustained yield basis so that the overall total board-feet of timber is constantly maintained.

The urban-regional context

Thus far, the concept of carrying

capacity has mainly been used and applied in relation to ecological systems. Many of the difficult problems of environmental management, however, arise in the urban-regional context. Since urban systems interface with natural systems, and since natural systems are a part of urban system, the interpretation of the concept of carrying capacities in this setting is receiving growing attention.

There is increasing interest in an interdisciplinary approach to the study of urban systems and ecological systems (urban ecology). Hollings and Orlans (1971) note that urban and ecological systems share four common characteristics:

> (1) a historical property, since both respond to present and past events;
>
> (2) a spatial property, since they respond to events at several different points in space;
>
> (3) a systems property, since both encompass many different component activities with complex feedbacks and interactions; and
>
> (4) a structural property, since they both exhibit characteristics of lags, thresholds and limits.

The second, the third, and particularly the fourth property point toward the potential usefulness of carrying capacity in the urban setting.

The American Association for the Advancement of Science symposium on urban ecology (1970) indicated that "like other man-dominated systems, the city is an unstable, highly productive, but poorly buffered system consisting of relatively few species and dependent on a large input of energy and materials. The city may be viewed as a detritus ecosystem in which all fixed energy originates outside its limits and from which large volumes of waste materials and diffused energy escape to the detriment of other systems." This emphasizes the interrelationship between urban and the surrounding non-urban area as urban sprawl and high mobility bring the contiguous agricultural and natural resource areas within the supporting resource base for urban activities.

The implications of carrying capacity concepts appear important for analyzing urban regional growth in terms of efficiency of energy and material transfer, handling of wastes and byproducts, and as support system activities influenced by succession, energy flow, population dynamics and territoriality. Hollings and Orlans (1971) summarize these ideas by stating that "it appears that we are quickly reaching the point where environmental limitation will inevitably impose constraints on urban systems."

Domains of urban regions

In extending the concept of carrying capacity to examine the capability of a region to sustain existing and proposed activities, consideration must be given to the character and extent of the resources, functions, and structures of urban areas which circumscribe the domains for carrying capacity in a region. The environmental planner and manager must understand such questions as: What are the relevant environmental resource components? How do they function? How do they interact with and influence other components, or conversely, how are they influenced by other components? What factors control levels of environmental quality and how do proposed activities affect those factors? The function and structure of urban environmental resources and their interactions with one another, then, are essential to specifying the domains of environmental carrying capacities for urban regions.

Urban resources

Traditionally, resources have been understood either as elements of the natural environment or as inputs to economic production. In urban areas, where much of the living environment is essentially man-made and serves as a means of organizing man's activities, our definition of resources and related environments is too narrow. For urban areas, rather than sticking to the usual land (with associated mineral deposits, forests, etc.), water and air delineations, the description of urban resources environments (Perloff, 1968) might be elaborated along the following lines:

- —Ambient resources: airshed, watershed, open space, quiet and noise zones, sunlight exposure.
- —Spatial resources: underground space, available and transitional surface space, airways space.
- —Infrastructure and distributive resources: transportation, water and water distribution, wastewater collection, energy (electricity and gas) distribution, communications.
- —Ecological resources: green plants, non-green plants, animals.
- —Socio-cultural resources: educational and cultural facilities, health services, security services (fire, police), recreation services, housing stocks.
- —Economic resources: raw materials for production inputs, capital, labor.
- —Amenity resources: seashores, scenic areas, contiguous natural areas (mountains, deserts, lakes), open space.

Resource characteristics

Some of the attributes or characteristics of these classes or types of urban resources which enter into an assessment of their capacity to support a particular activity or changes in sets of activities are:

(1) Quantity and quality: Quantity and quality are two resource attributes inextricably connected in relation to carrying capacity for a particular activity or use (e.g. volume of water of quality for drinking, or for cooling; space available for movement of vehicles, or for construction, or for open space).

(2) Renewability: The quantity and quality of a resource is, in turn, closely related to its characteristics of renewability on nonrenewability. Stock resources, such as mineral deposits, fossil fuels, and available land, are essentially fixed in quantity and, in that sense, non-renewable. The capacity of such resources for supporting urban systems, therefore, depends on rates of use or exploitation, the possibilities for salvage and recycling or the development of substitutes. Naturally renewed resources (natural vegetational and animal growth) and flow resources (solar radiation, and natural cycles for water and other elements) have renewable characteristics in which process rates determine the quantity and quality available in a given time period. Capacity of renewable resources depends on the care and efficiency of man's intervention in the use of the resource without upsetting or destroying the natural processes which assure availability of the resource.

(3) Spatial distribution: Spatial distribution is related not only to resource location, but also to identification of the resources which are part of the urban region itself. Drawing boundaries around the urban region in order to circumscribe geographically the resources which contribute to its carrying capacity may be a difficult and sometimes arbitrary task. Electrical energy, water and fossil fuels are often situated large distances from actual centers of urban activity. Should they be considered as external or imported resources? This question raises the broader issues of environmental quality relations between areas of resource extraction or production and areas of resource use.

(4) Economic and social costs: The classical concept of common or "free good" resources has little validity in terms of carrying capacity for sustaining regional activity and growth. There is now a high value associated with maintaining the quality of ambient resources such as air and watersheds. The industrial firm dumping wastes directly into a stream, airplane

flightpaths over residential areas, the individual automobile adding to congestion and air pollution, and the building that blocks out the sun are all examples of individual actions contributing to a deterioration in environmental quality for the entire society.

A description of the urban "resources" compatible with aspects of urban environments may provide a structure for determining how growth, as measured against resource capacities, will affect regional environmental quality.

Urban activity—systems, linkages

Superimposed upon the mosaic of social, economic and ecological resources of a region is the domain of urban activity systems and their linkages. The composite of urban activities, both public and private, contributes to a set of regional outputs which enhances the quality of life. Urban activities are linked and supported by the infrastructure and resource distribution systems of the region, transportation, water distribution, and energy distribution. The current capability of the infrastructure and the resources they distribute to sustain activity are a key aspect of the "carrying capacity" of an urban region, and represent short and medium run constraints on regional quality growth.

People and institutions

People and institutions represent the third important domain of carrying capacity for urban centers. Institutional and individual values, as reflected in present or desired life-styles of the residents of urban areas, should have an important influence in determining quality aspects of regional growth.

To translate the broad concept of carrying capacity into a useful tool in achieving quality regional growth requires answers to the following questions: What will be the demands on the environment as a support system relative to the quantity and quality of available resources? At what resource and quality levels will the environment as a support system fail? How do changes in an activity affect the environment's capability to sustain other current activities or new developments and activities? What measures would be most useful in analyzing environmental carrying capacity? Exploring the concept of carrying capacity as related to quality regional growth will hopefully provide a structure for answering these questions.

Urban-ecological structure

The concept of carrying capacity is useful only as it enables the environmental manager to assess and evaluate the impact of various proposals on regional environmental quality. In making such judgmental decisions, carrying capacity is related to two important qualities of ecological and urban systems (Holling and Orlans, 1971).

Stability in ecological and urban systems is due to the existence of damping forces that tend to move the systems towards an equilibrium state. However, since the equilibrium changes continuously with time, the importance of stability is with reference to the structure of the system.

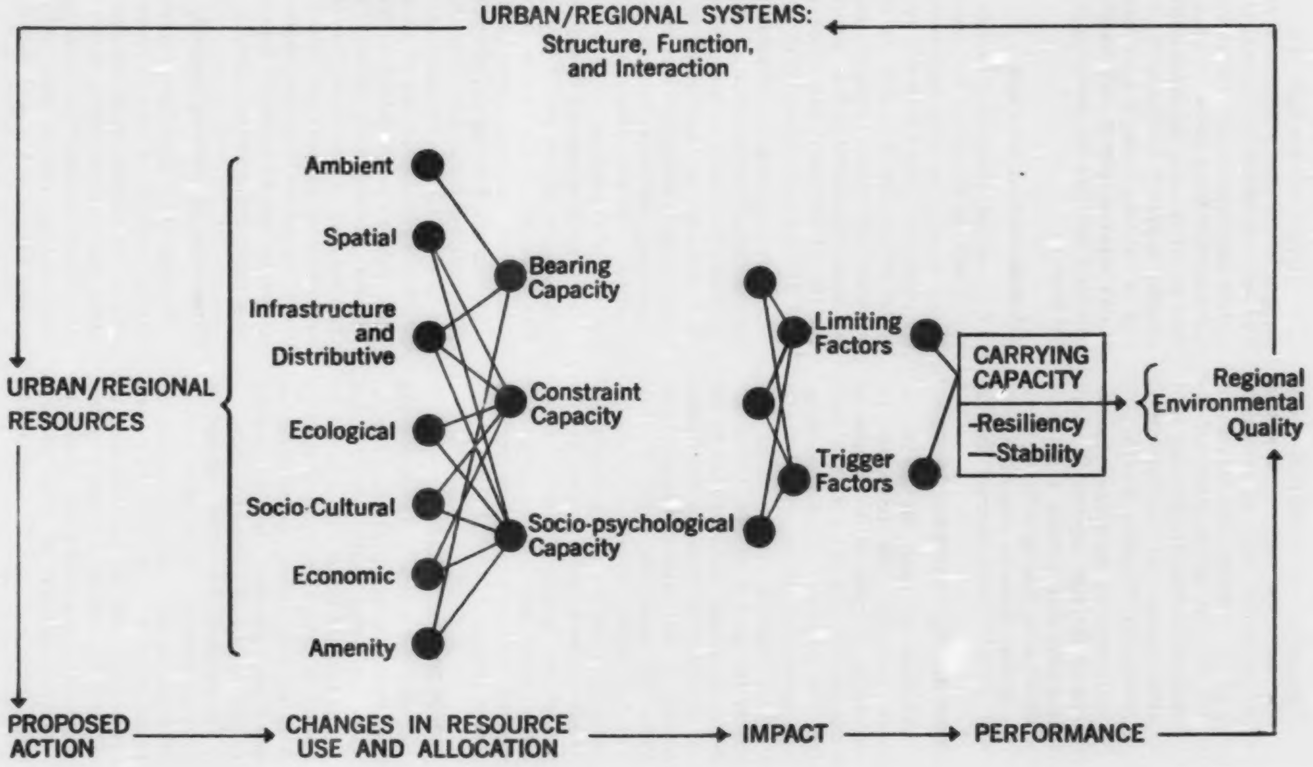
Resiliency is a measure of the limits of stability of the system. If transients shift elements of the system beyond domains of stability, then radical change occurs. The concept of resiliency encompasses the idea that incremental changes may be absorbed, but cumulative effects of small changes might reduce overall system resilience.

Again, Holling and Orlans (1971) stress the need to understand "the complex nature of tradeoffs and limitations in options and resilience that characterize systems operating close to the carrying capacity of the environment."

Dimensions of carrying capacity

Working from these basic notions in carrying capacity, Figure 1 illustrates some of the dimensions of carrying capacity and suggests that a determination of carrying capacity is based on an understanding and analysis of both limiting factors and trigger factors.

FIGURE 1.—OVERVIEW OF CARRYING CAPACITY RELATIONSHIPS.


URBAN/REGIONAL SYSTEMS:
Structure, Function, and Interaction
URBAN/REGIONAL RESOURCES
Ambient
Spatial
Infrastructure and Distributive
Ecological
Socio-Cultural
Economic
Amenity
Bearing Capacity
Constraint Capacity
Socio-psychological Capacity
Limiting Factors
Trigger Factors
CARRYING CAPACITY
-Resiliency
—Stability
Regional Environmental Quality
PROPOSED ACTION
CHANGES IN RESOURCE USE AND ALLOCATION
IMPACT
PERFORMANCE

The *limiting factor* is an environmental factor which limits growth, reproduction or resource use of an individual, community or activity either physically or behaviorally.

The *trigger factor* is a new or changed environmental factor which sets off a chain of events in an ecological or urban environmental system.

The carrying capacity of a system then may be described by the limiting factors and trigger factors which are operationally significant, i.e. those factors which effect a decline in some valued aspect of regional environmental quality. Three general dimensions of carrying capacity are appropriate areas for analysis of limiting and trigger factors as related to urban resources, structure and activity:

Resource-bearing capacity

Resource-bearing capacity is basically a biological and resource-flow definition. Capacity is examined in terms of the levels or input rates for an activity that can be withstood by the biota or the resource flow systems and still return to an unimpaired state. Essentially, this suggests a non-impairment criterion for establishing levels of use which can be sustained for an indefinite period of time without altering or degrading the resource. The underlying objective, then, is achieving a maximum sustained yield for a given activity. The important factors in analyzing resource-bearing capacity are the ability of the resource to produce the kinds of services required, and the ability of the biota or flow system to recover after peak use; for example, the ability of air and water to assimilate certain pollutant waste-loads over a period of time without deterioration of ambient quality conditions.

System constraint capacities

System constraint capacities are concerned more with the physical limits of resources or of resource processing and use systems. The former would be considered in terms of non-renewable stocks or resources such as mineral deposits, fossil fuels, and available land (in the short and medium run), and the rates at which such resources are being developed and used. The capacity for use of both non-renewable and flow resources may also be limited by the capability of the present system to process and use them. For example, a certain forest area might be producing a net annual increase in timber which is greater than can be harvested on a sustained yield basis because of its inaccessibility from the current transportation system. The objective indicated by this definition is efficiency in resource use and in the management of resource processing systems.

Social capacities

Social carrying capacity is related to the overall levels of satisfaction experienced by users or other affected individuals resulting from resource management practices. Social capacity is stated in terms of maximum number of use-units (e.g., people, vehicles, etc.) that can utilize available resources during a specified period of time for one or several activities, while providing a satisfactory experience for the users. The operationalization of this goal in determining a "satisfactory experience" might be to maximize the total user satisfaction. Before determinations may be made about levels of "satisfactory experience, the kinds of experience the resource is expected to provide must be established. A particular resource or group of resources may be capable of providing for several different types of activities. Some of these activities will compete for the resources, while others may be compatible. Inevitably, this will require management decision about which resource use or combinations of uses will be pursued. Examples include whether a particular tract of land should be managed for wilderness recreation or developed with access roads and recreation facilities, and whether a particular tract of urban land should be zoned and managed as open space or for various kinds of residential and commercial development. When deriving a set of management objectives, one must consider the feasibility of the objective in terms of resource-bearing capacity and system-constraint capacities.

The aspect of "satisfactory experience" or user satisfaction is a function of individual attitudes with respect to the management objectives in question. For example, "How many people can be handled in a wilderness area at one time before the wilderness experience is lost?" or stated another way, "What number of people maximizes the total satisfaction in the use of the resource for a wilderness experience?"

The quantitative application of this criterion in determining optimal capacity of resource based recreation facilities is discussed by Fisher and Krutilla (1972). A brief review of their example will provide a clearer picture of the idea of social carrying capacity. Figure 2 depicts a special set of aggregate demand schedules. The horizontal axis represents recreation intensity, i.e., the number of recreationists per unit time. The vertical axis represents quality of the recreation experience as measured in some unit of satisfaction (this could be a price in dollars consumers were willing to pay for a given quality of experience). For ease of explication, assume a family of demand curves, each one valid over a certain range of recreation intensity. Moving from bottom to top, each curve represents a higher quality experience due to slightly lesser intensity of recreation use. Thus the level of satisfaction as measured by the willingness to pay is higher. From these demand schedules the intensity of recreation activity which achieves the maximum level of satisfaction can be deduced in the following way: The total satisfaction for recreation intensity of q_1 is the area under the demand curve DD_1'. If we move to a level of intensity q_2 there is a gross gain in user satisfaction of the area under the x_1D_2' portion of the curve DD_2', but also a loss of satisfaction represented by the area $D_1D_2Dx_1D_1'$. The net gain in user satisfaction is therefore the difference of the two areas. We can continue to achieve increases in user satisfaction by increasing intensity, as long as the net gain from higher intensity use is positive. The point at which the net difference becomes zero is interpreted as the optimum capacity since moving beyond this point results in a decline in total satisfaction. This may be seen graphically by plotting the total and marginal benefit (stated in units of user satisfaction) curves as shown in Figure 3.

The example illustrates limiting factors in determining carrying capacity from the standpoint of individual and social values and behavior. Our perception of the quality of the environment in which we move, work, and play, and the environment's capacity to sustain these activities at "satisfacory" levels is closely related to the levels of social stress and congestion costs experienced by the user.

Environmental management

In developing environmental management strategies for an urban region, planners and decision makers must continually assess the social and environmental implications of vigorous proposals. Recognizing and establishing the limits of capacities of regional activity support systems along the dimensions described above could provide decision makers with a workable approach to assessing the impact of proposals.

Indices have begun to develop as a means of providing a working knowledge of environmental quality and of charting trends and changes in quality levels. The development of carrying capability concepts may extend the usefulness of these indicators to provide for comparative evaluations of environmental quality dimensions in terms of ranges and limits of acceptable levels and the impact of various regional growth policies, rather than merely the presentation of trend information.

Regional environmental management models which incorporate the concept of carrying capacity may thus be used to examine the character of changes

FIGURE 2

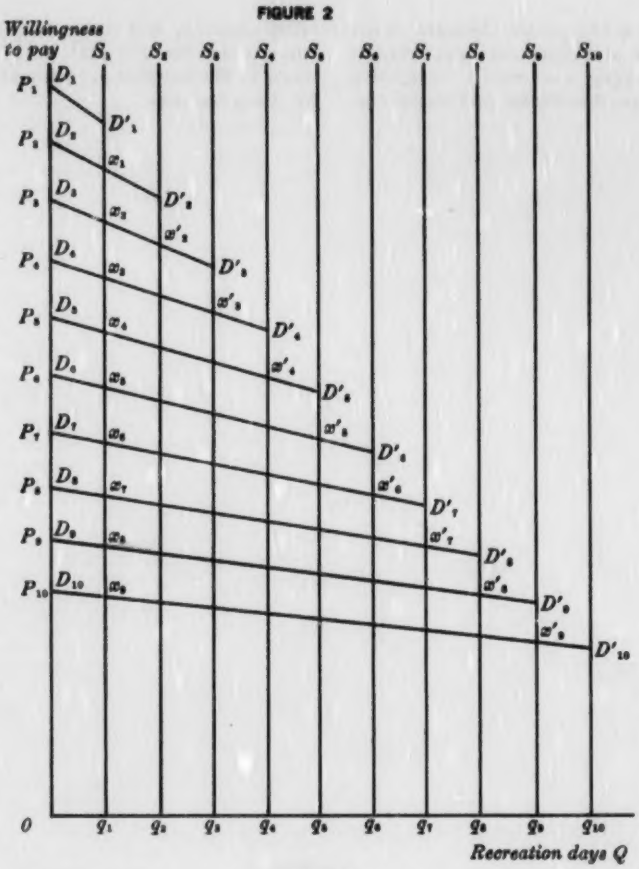
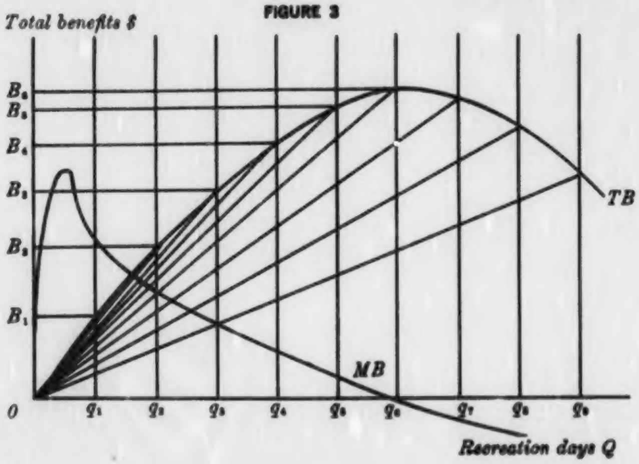


FIGURE 3



that will occur under different levels of activity and types and use, whether such changes are within acceptable limits of environmental and social carrying capacity, and the ways predicted changes in the physical environment relate to the social objectives and values for resource use.

V.2 Land-use planning: the cornerstone of local environmental

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Land-use planning viewed within the framework of the overall urban planning process is only that sector of planning concerned with the location and intensity of various urban activities. Yet, insofar as land use creates the physical setting for economic and social system activities and is the physical expression of these systems within the environment, its impact is complex and far reaching. Moreover, land-use planning should serve as the basis for other physical development planning: open space, transportation, public utilities, public facilities, etc.

Land-use decisions, once enacted into physical development, remain within the urban system for many years. Unless massive urban and suburban renewal every few years is to become the rule of thumb (as in fact some urban observers have proclaimed to be the only option), land-use decisions must be made with an eye to placing all objectives within a comprehensive and systematic framework.

Limits of land-use planning

Pollution, which may be viewed as the residual of the overall urban production process, may be abated in three basic ways: through modification of residuals after production (e.g., sewage treatment), through modification of the production process itself to reduce the amount or change the character of the residuals generated (e.g., altering the basic industrial process), or through utilization of the assimilative capacity of the environment to reduce the degradational impact of the residuals generated (e.g., locating industries along the river into which they discharge at sufficient intervals to allow the river to "recover" or assimilate the residuals before receiving another load). The latter approach, utilizing the assimilative capacity, involves land-use planning in its generic sense. Nevertheless, some types of environmental problems are of such character, intensity, or common proliferation that land-use planning cannot cope with them. This is often the case in intensely developed urban areas where land is not subject to easy changes and existing conditions make it impossible to plan within the assimilative capacity constraints. Land-use planning as here discussed, therefore, is a means for promoting environmental quality most appropriate to developing urban areas.

Evolution of land-use planning

The traditional approach to land-use planning begins with a projection of future economic growth in the urban area.[1] This projection is based on trends in both the national and regional economy. It reflects the potential of the given urban area to capture a part of this total growth and in some cases the hope of the community to do so as well. Given the projection in amount and type of economic activity, future population is estimated. These two projections are then translated into estimates of future demand for industrial,

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*Excerpted from *Promoting Environmental Quality Through Urban Planning and Controls*. A research report done at The Center for Urban and Regional Studies, The University of North Carolina at Chapel Hill for the Office of Research and Monitoring, Environmental Protection Agency. Excerpts are from a review draft.

commercial, residential, and public activities. Land supply is evaluated according to suitability and capacity for these various activities. The suitability and capacity of a land parcel is defined in terms of its location or accessibility, size, and general physical quality.

The basic assumption of this approach is that economic growth will bring positive benefits to the community and that such growth can be best fostered by designing the land-use pattern to maximize accessibility within the system of economic activity. Further related assumptions include: 1) an unlimited supply of land suitable for urbanization exists, 2) a city is essentially an economic production unit and should be organized in a manner most efficient for such production and 3) the negative effects of spatially organizing land use according to economic activity criteria can be assuaged through technological solutions *after* they are discovered, solutions which an economically productive society will be able to afford.

These assumptions began to come under scrutiny in the 1960's when the effect of the emphasis in land-use planning on economic system efficiency became more fully disclosed. Pollution in urban areas was high, and the cost of reducing it where it was still possible, through technology alone, was extreme. More forms of environmental degradation, however, appeared more permanent. For example, rich natural areas and farm lands, long accessible points of amenity to urbanites and necessary ingredients to the American definition of the quality of life, were rapidly disappearing as cities expanded through haphazard suburban sprawl across the rural fringe. Furthermore, the very effectiveness of planning characterized by long range master plans to be implemented primarily through zoning came under question.

The following discussion will present some of the approaches currenly being taken on each of three fronts of innovation:

1) in the redefinition of comprehensive planning to incorporate a concern with land use/environmental quality relationships;
2) in the inclusion of environmental system information and evaluation criteria in land-use plan and policy development;
3) in the emphasis on implementation and therefore in the creation of a more sophisticated urban planning process—guidance system planning.

Redefining comprehensive planning

There are two basic ways in which comprehensive planning is being redefined or reorganized to reflect environmental objectives. The first approach is to add a new sector to the total planning program which will focus specifically on environmental systems in a manner parallel to that of other sector planning such as economic development, social policy, or transportation. The second approach involves a more fundamental realignment of comprehensive planning. Thus, an attempt is made to examine the relationships, both supportive and conflicting, among the objectives of the many urban systems and to develop some resolution among them which will guide planning within the various sectors toward a more coordinated goal set.

The first approach, adding a new sector to comprehensive planning, parallels that taken at the federal level and by many states whereby a separate environmental planning sector or even a separate agency is established.

Huntington, New York, for example, recently created a local environmental protection agency. The agency is involved in the traditional pollution oriented programs related to air, water, solid waste, noise, and pesticides as well as land conservation. In the spring of 1972, the town of Huntington sponsored the design of an environmental planning program for the area by a group of graduate students in the Department of Regional Planning and Landscape Architecture at the University of Pennsylvania.[3] The program involved an inventory of natural systems in the area (land, water, climate, plants, sea, people, and amenity) and from this, areas for protection, remedy and redevelopment were designated and policy actions recommended. To a large degree, the actions proposed for each type of designation were related to questions of land use and development. The extensive data collected by the students, much of which is in map form and the program design itself is now housed within the new Environmental Protection Agency.

The primary formal procedure by which environmental objectives are interjected into the planning and development process is through the requirement for environmental impact statements. Huntington requires environmental impact statements to be submitted on all public development proposals, whether funded at the federal, state, county, or local level, and on industrial use and subdivision requests by private idividuals.[3] Agency personnel use the information and codification scheme when they are called upon to comment on the environmental implications of development proposals.

Adding to the general plan

Another example of this approach is Los Angeles. There the Department of City Planning is adding a new sector to the General Plan—"An Environmental Conservation Element."[4] It should be noted that this approach is mandated by the State of California in its Planning and Zoning Law.[5] In California, all cities and counties are required to adopt general plans which must contain nine elements: Land Use, Circulation, Housing, Conservation, Open Space, Seismic Safety, Noise, Scenic Highway, and Safety.

The new component of the General Plan represents a compilation of data from technical reports and interviews with personnel from various city agencies involved in environmental questions. Environmental issues are divided into six categories: air pollution, water quality, noise control, the conservation of land and resources, solid waste disposal and pesticides. The report, while providing the basis for the new element of the General Plan, is also intended to serve several secondary, yet perhaps more critical, functions:[6]

> These include (1) serving as a comprehensive framework through which the multitude of governmental and private agencies, citizen groups, etc., can perceive the interrelationships between various aspects of the environmental problem, (2) providing the specific policy recommendations needed for the formulation of additional standards and legislation pertaining to environmental quality, (3) presenting guidelines for the modification of City procedures so as to minimize the negative impact of City operations on the environment, and (4) as a general and comprehensive data source for information pertaining to various environmental questions in Los Angeles.

California law now requires that all cities and counties "make a finding that any project they intend to carry out, which may have a significant effect on the environment, is in accord with the conservation element of the general plan."[7]

In the approach exemplified by both Huntington and Los Angeles, environmental objectives are examined somewhat separately from other community objectives. No explicit attempt is made to reassess other community objectives related to social or economic goals which may, by their very nature, frustrate the achievement of environmental quality.

Changing community goals

The second approach to redefining comprehensive planning involves a more fundamental realignment of all community objectives in the light of a new awareness of the environmental implications. Environmental quality is viewed as an integral facet of the broader goals related to the "quality of life."

For example, Wayne County, Michigan, embarked on a new approach to comprehensive planning in 1970 in which environmental quality was posited as one of the most fundamental issues of urbanization. To a large extent, the redefinition of comprehensive planning for Wayne County has involved a rather compflex process of long-range goal planning for the area. The data generated through the process is aimed more at redefining the mind-set which the public and its decision makers bring to questions of urbanization to include an understanding of the complex and interdependent ecosystem rather than pointing to specific action recommendations.[8] The recommendations included in the volume on environmental quality . . . while not all are directly related to questions of land use, do exhibit strong implications for land-use guidance:[9]

A. Establish an optimum population range for the County so that the total spatial needs of the population can be met.
B. Adopt policies and methods to insure the full range of life-style options to all citizens.
C. Program gradual steps to adjust the economy of the County to the optimum of Population "A" above.
D. Urge the transition of energy generation to other than fossil fuel sources.
E. Urge and require recycling of exhaustible materials.
F. Recognize the relationship of taxation and municipal boundary issues to environmental problems and take appropriate steps.
G. Conserve land resources by erosion and sedimentation-control ordinances at both municipal and county levels.
H. Develop jointly with the Chamber of Commerce and Economic Development Agencies methods of identifying, reporting and coping with *nonfiscal* costs of pollution.
I. Periodically report public and private *fiscal* cost of pollution.
J. Adopt policies and methods (zoning and/or acquisition as examples) which preserve open land.
K. Urge consumer participation in environmental protection efforts.

Alternative futures

The Albuquerque-Bernallillo County Planning Department took a similar approach to redefining comprehensive planning goals. The Department published a discussion of community goals within the context of long-term environmental system constraints.[10] *The Comprehensive Plan, Metropolitan Environment Framework* assesses past and future trends in environmental quality and poses two alternative growth strategies based on two different goal-sets to deal with the identified trends. The first option would require more stringent public controls of urban growth aimed at simply modifying the trends in degradation to an accepted degree. The second approach is based on a fundamental alteration of trends to insure optimum long-term environmental quality. For example, under "Strategy 1" population size would be estimated according to a determination, as yet undefined, of the local resource capacity. In terms of land use, "Strategy 1" would require standards for location and control of development rates. Strategy 2 would call for improving land through land development.

These two orientations to the redefinition of comprehensive planning goals represented on the one hand by Huntington and Los Angeles and on the other by Wayne County and Albuquerque differ primarily in purpose. In the case of the first two examples, the intention is to develop an action program to achieve agreed-upon environmental objectives such as national standards for air and water quality. The time frame of such planning is thus rather short-range. In the second approach, the objective is not so much to develop an immediate action program as it is to develop an understanding of the complex interdependencies among environmental systems and the relationship of urban man to the ecosystems within which he participates.

Actually, these two approaches need not be viewed as mutually exclusive. It may well be that both approaches are necessary and should be undertaken simultaneously.

The second front: The land-use planning process

Recent approaches to defining an environmental system information base for planning may be viewed as reflecting three general schools of thought. The first focuses on an inventory of the key natural sub-systems in the planning area which pose resource constraints on urban development. The second approach is also based on an inventory of the natural sub-systems but emphasizes their interpretation as interdependent processes in the ecosystem. The third approach also inventories key natural sub-systems but interprets their significance in terms of man's visual perception of the environment. The three approaches, thus, may be termed respectively—a natural system inventory analysis, an eco-system analysis, and a visual landscape analysis.

Regardless of the approach taken to resource analysis, the information generated may be used at various stages in the planning process to monitor current environmental trends and predict future conflicts in order to focus planning priorities, to determine the optimal land-use allocations from an enviornmental quality perspective as an input along with other economic and social system demands for land-use planning, to determine the environmental impact of alternative plans or policies in order to select the best one and to determine the design of a project once the general alternative has been selected in order to foster the best fit between the demands of urban man and the demands of nature (the assumption here is that, to a certain extent, modern urban man's life style is simply not completely harmonious with the demands of the natural environment).

Natural systems inventory

The primary objective of this type of natural resource inventory is to develop a natural features information base which may be used in the planning process as a rationale for determining optimal space allocations for land use. The central operating principle is that specific features of the natural environment exhibit an intrinsic suitability for some land uses more than for others. Common environmental sub-systems inventoried include geology, pedology (soils), hydrology, meteorology, climatology, plant associations, and fish and wildlife.

At present, there appear to be two fundamentally contrasting objectives: first, to determine environmental constraints to development and second, to protect the environment from development.

The study, *The Natural Features of the Washington Metropolitan Area,* prepared by the Metropoltian Washington Council of Governments is an example of an inventory conducted to determine environmental constraints to development.[11] The study focusses on seven natural features of the area which impact on development: Geology, Minerals, Elevation, Slope, Soils, Streams and Drainage Basins, Flood Plains, Groundwater, and Woodlands. Woodlands are the only plant associations identified and this is justified on the grounds of aesthetics and amenity, conservation, and direct economic value as a commercial product. Fish and wildlife are not assessed. Those features that are identified were selected because of, and evaluated with respect to, their impact on urbanization. The information is finally synthesized into a "natural features composite." The composite map "shows some of the areas where public policy should reflect the limitations or opportunities [primarily for economic gain] inherent in the physical environment: areas of shallow depths to bedrock; poor drainage areas; areas having mineral resource potential and areas where landslides, flood plains, and severe slopes occur."[12]

Since the publication of *Design with Nature* in 1969, the name Ian McHarg has become associated with the second approach to environmental systems analysis emphasizing the protection of natural processes.[13] Hence, McHarg's environmental analysis of the Twin Cities Metropolitan Area shall be described to represent an inventory and analysis of key natural systems for the purpose of their protection.[14]

The list of phenomena thus inventoried are similar to those identified in the Washington study although plant associations and fish and wildlife are given attention here: climate, historical geology, bedrock geology, superficial geology, foundation conditions, economic minerals, physiography, hydrology (surface water and ground water) pedology, plant associations, fish and wildlife, and existing land use.

The major environmental systems inventoried are evaluated in terms of relevance to four land-use groups:[15]

Production. Those land uses related to production from the land. Examples are: agriculture, forestry, wildlife propagation, and mineral extractive industries.

Protection. Those land uses whose primary purposes are to preserve, protect, and conserve those elements of the natural environment considered to be unique, scarce or vulnerable or constitute a hazard to life and health. Such resources may include erodable slopes, flood plains, and recharge areas.

Recreation. Those land uses whose primary purposes are to enable the constructive use of leisure time in an active or passive manner.

Urbanization. Those land uses related to residential, commercial, institutional, and industrial developments.

Attributes of each environmental subsystem are ranked on a scale of 1 to 5, one being most desirable and five being least desirable, for each land-use category.

Using geology as an example: bedrock, flat land on sands and gravels, flatland on drift, sloping land on sands and gravels, sloping land on drift, and alluvium, lake deposits, eskers and kames, are given successively lower values as foundation materials.[16]

Next, relevant natural phenomena and processes are incorporated into suitability classes. A matrix for each environmental sub-system comparing its relevance to the four land-use groups is developed.

The matrices are then used to map the intrinsic suitability of each specific land use (e.g., production involves agriculture, forestry, wildlife production and extractive minerals). These maps are combined into four maps of the intrinsic suitability for the four major land uses and finally a single synthesis map is produced. Each prospective land use is ranked in order of relative importance. Ranking could vary according to the objectives of the community. The rank order selected in this case was protection, urbanization, agriculture, active recreation, forestry, and extraction; thus, highest priority was placed on areas designated of natural value.[17]

A matrix is prepared in which all land uses are listed on each coordinate. Those which were compatible if coexisting are so identified as are those that are incompatible. Mapping proceeds by identifying the category of Protection with the compatible and permitted land uses. Thereafter, all prime urban land not in competition with any other category is mapped. Prime urban is next mapped showing competition with prime Agriculture and prime Recreation. This procedure is followed through the hierarchy of the matrix. The final map reveals not only single intrinsic land uses, but those that are complementary and competitive, in a range of values.

Ecosystem system analysis

The second approach to environmental system inventory and analysis differs from the first primarily in the scale of investigation. While the first approach necessarily involves a rather general cut of natural features such as hydrology, pedology, meteorology, and wildlife to be incorporated in the general plan-making process, an ecosystem analysis examines the living organisms and their non-living environment found at the project site level.

Although few studies of this type have actually been conducted, the ecological analysis model proposed by Dr. J. Frank McCormick perhaps best represents the approach.[18] McCormick suggests the following steps for an ecological analysis:

1) Identify species present.
2) Determine species distribution and abundance.
3) Identify species associations, and describe the distribution and abundance of the major plant communities.
4) Interpret what factor or factors most strongly influence species distribution.
5) Relate species and community distribution to ecological processes which should be considered in development plans.
6) Attempt to place relative importance values on individual species, communities and areas of the study area.
7) Recommend certain development procedures which should or should not be followed.

The ecological analysis thus traces the linkages and interdependencies among environmental elements at a more detailed level than is approached in a broad natural systems inventory. The key operating assumption is that an area which incorporates several subsystems (for example, a coastal marshland which is a multiple species—fish, wildlife, and vegetation—habitat) is necessarily more complex and thus less tolerant to human activity.

McCormick's approach would lead to the development of a site design plan which specifies precisely what species, populations, and community size and location should be preserved to maintain the "character" of the area as a viable ecosystem.

Visual landscape analysis

The third approach to environmental system evaluation for planning is the visual landscape analysis. The overriding objective of the visual analysis approach to the study of environmental systems for planning is the identification, protection and enhancement of landscapes which contribute to the visual quality of the environment. The operating tenet of the visual analysis, however, is that landscapes with visual quality are likely to be significant in terms of physical and biological processes which are focused there; therefore, those areas should be carefully managed to protect a resource significant not only for reasons of amenity or aesthetics but also the general health and safety of man and nature.

The third front:
Land-use guidance system

New goals, new information and a new emphasis on implementation have spawned the development of many new methodologies for incorporation into the land-use planning process. The potential synthesis of these methodologies points to a new land-use planning process which we have termed guidance system planning. The ultimate aim of this new process is in infusion of goals and information, which now reflect an environmental system or natural process orientation, into the urbanization process. In this section, an operational view of the guidance system planning process will be presented in some detail.

Stage 1:
Inventory, monitor, predict

The first stage in the process involves an inventory of natural systems in the area, existing land use, and many other factors traditionally analyzed as informaterial input for land-use planning. In addition, indicators of urban and environmental system performance may be monitored to explore current trends and predict future system performance. Essentially, the inventory is a background study intended to delineate the scope of local problems related to the goal of environmental quality. Hence, the inventory stage facilitates the definition of goals into objectives.

The information system for environmental systems produced through the inventory may be combined with a monitoring of urban growth or a predictive model of potential growth patterns to forecast possible points of conflict between development demands and natural system demands. The "Early Warning System" developed for the Santa Cruz Mountains area illustrates one approach to developing such a prediction capacity.[19] Essentially, the model is "a predictive tool for locating potential development and dynamics conflicts." [20]

The "Early Warning System" model illustrates a method of predicting those areas where there is likely to be a conflict between natural dynamic systems and five forms of development: selected residential, logging, tree farming, grazing and speciality crops. All of these uses are presently found in the study area, but the method is theoretically applicable to any use. The system includes a comparison of a mapped expression of developer interests in terms of physyical potential with a mapped expression of the natural dynamic systems of the same area. Land uses are reduced to a common level by the consideration of the actual physical impacts which development produces rather than its "land-use" category. With the use of an Early Warning map the planner could easily identify the areas which are likely to have potential impact problems in advance of actual development. The nature of additional information which is required can be identified through an impact analysis process and land-use policies can eventually be developed to avoid or at least minimize further environmental degradation. The model, carried out in this study by traditional mapping methods, is based upon a coordinate grid system which was developed to efficiently store quantities of complex information so that it could later be converted to a computerized information system.

Stage 2: Decision guides

Decision Guides are those plans, policies, budgets, and procedures developed by the planning staff to aid the local governing body in their decision-making capacity.

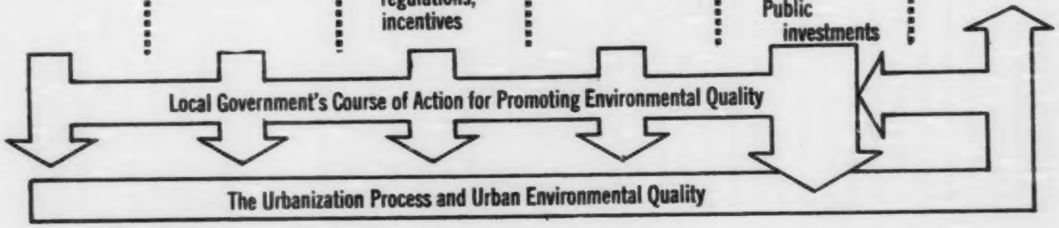
Traditionally, the land-use plan has served as a decision guide. The land-use plan is a very generalized vision in map form of the desired future physical characteristics of the urban area in terms of the location, intensity, and amount of land which will be developed for various space-using activities. Insofar as the land-use plan presents a visual interpretation of physical characteristics, some twenty years hence, it has not been the most effective context of information and objective clarification necessary to evaluate the implications of these more discrete day to day decisions affecting land use. Thus, the land-use plan is often supplemented by policy recommendations as well as more detailed policy and program plans focusing on more specific issues within a shorter time horizon than the ten to twenty-year reference of the traditional land use plan.

The *Optimum Land-Use Plan* for Redmond, Washington is an example of a land-use policy guide which emphasizes development based on congruence with natural land features.[21] Land capability was evaluated in terms of surficial geology, current pollution levels (air, water, and noise), physiographic features (surface water, marshes, 100-year flood plain, acquifer recharge areas, slopes), climate and hydrology, vegetation and wildlife. Development principles appropriate to the conservation or improvement of each factor were recommended. Prior to the design of the "optimum" land-use plan, the compatibility of land use to land use (e.g., camping with surburban residential development) and land use to land

FIGURE 1.—LAND USE GUIDANCE SYSTEM PLANNING PROCESS

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6
THEORETICAL RATIONAL PLANNING PROCESS	Problem identification and analysis	Goals, objectives, and choice criteria	Formulation of alternatives	Evaluation of alternatives	Action decisions	Feedback
LAND USE PLANNING ACTIVITIES	Inventorying, monitoring, prediction interpretation	Formulating general goal-oriented decision guides	Formulating specific decision guides and action instruments	Testing alternative plans and predictions	Selecting and implementing action instruments	Monitoring the urban environmental system and performance action instruments
OUTPUTS OF PLANNING ACTIVITIES	Background studies, status reports, suitability maps	Goal plans, choice criteria policies, strategies	Specific Budgets, policies, plans, programs, projects, model regulations, incentives	Effectiveness and environmental impact analyses	Indirect actions: Regulations, Incentives, Public investments. Direct actions: Public investments	Monitoring environmental quality indicators. Public surveys. Political activities.

CONSEQUENCES



Local Government's Course of Action for Promoting Environmental Quality
The Urbanization Process and Urban Environmental Quality

(e.g., commercial activity to slopes over 30%) was assessed as either being incompatible, moderately compatible, or fully compatible. In addition, each type of land use was rated as severe, moderate or minimal in terms of its potential adverse environmental consequences (e.g., soil erosion or stream sedimentation potentials). The resulting matrix of "land-use intercompatibility" was then a decision guide for the plan design stage. Furthermore, a policy to "optimize multiple compatible uses, as well as single uses" was posed as a decision guide. Other inputs to the design stage included evaluations of the economic base, projected land absorption, population growth, housing needs, development pressures (including parcel size and distribution and the prevalence of land speculation) and existing and projected land-use distribution.

The Huntington, New York Environmental Planning Program discussed previously is an example of a stricter policy plan approach.[illegible] No future land-use plan in map form is presented. Rather, specific management actions are recommended, evolving from an inventory of the natural systems in the area. These actions would apply generally throughout the area (e.g., the prohibition of nitrogen-carrying fertilizers). In addition, certain areas of the town are singled out for special attention: *remedial action* (e.g., installing tertiary sewage treatment for existing development where cesspools and septic tanks exceed 1/acre); *redevelopment* of the urban infrastructure to restore ecological equilibrium (e.g., redesigning the storm drainage system into the local harbor); and *protection* of natural resources (e.g., public acquisition of remaining open spaces.)

A policy plan may focus on a more limited facet of the land-use environmental quality interface. For example, the Southeastern Wisconsin Regional Planning Commission has developed a *Soils Development Guide*.[illegible] The *Guide* was prepared for distribution to local jurisdictions within the seven county region. The Atlanta Regional Commission recently completed a policy plan for an area-wide resource, the Chattahoochee River Corridor. The plan examines the use of a 48-mile stretch of the river north of Atlanta and the adjacent land 2000 feet from each bank. The report recommends a comprehensive land development plan for the adjacent areas, development guides (some of which are posed for county-wide adoption, *e.g.*, soil erosion, sediment control and flood plain development regulations; others for adoption only within the 4,000 foot corridor, *e.g.*, general development standards, a "River Buffer Zone." Flood Hazard Zone, PUD standards; and a voluntary protection zone), and a program for public acquisition of certain areas vital to public recreation or the ecological health of the corridor.[illegible]

Stage 3: Policy proposals

The third stage in the process is the generation of specific policy or project proposals. For example, in the *Optimum Land-Use Plan* for Redmond, Washington cited above, it was recommended that the city acquire open space through less than fee simple purchase. If Redmond is to acquire open space in this manner, it must first determine which of the several approaches to less than fee simple purchase is most appropriate to its objective of open space preservation. Each of the alternative purchase arrangements must be examined in some detail. In the same plan, it was also recommended that floodplains, steep slopes, and mash areas be carefully managed. Alternative approaches to such management remain to be proposed.

Stage 4: Testing alternatives

The fourth stage in the process is the testing of alternatives. Alternatives may be tested for two purposes: First, to determine the general effectiveness of the proposal in achieving the objectives desired and second, to determine the environmental impact of the proposed action.

Evaluation of Effectiveness. In the

"Computerized Guidance System" developed by Bucks County, Pennsylvania, a variety of data is collected and organized on a 22.95 acre grid basis and placed into model form in order to "relate the effect of a set of policies on a plan . . . to assist the County commissioners in establishing and following policies to achieve the desired end." [illegible]

A series of policies was combined to produce a County Park Plan using this system of data and modeling links. Seven major policy areas were defined related to open space objectives: maximum utility, site quality, accessibility, proximity, land value, supply and demand, and threat. For example, in terms of maximum utility, the operating policy was that "the park site which is suitable for the greater number of recreation activities is a better site than one suitable for fewer activities." Each policy was then converted into a model:[illegible]

> Some of these models are sets of overlays, whereby a variety of factors are combined to determine suitability for parks. The Site Quality Map is illustrative of this type model. The accessibility model is a behavioral model, based on a formula derived from a survey of county residents. Its basis is the observed effect of distance on frequency of park visitation. The threat model is a simulation model. Variable were: population growth by municipality, vacant land by municipality, presence of sewers, proximity to highways, and existing urbanization. No attempt was made to base this model on observed data.

The models for each objective were given a priority weighting and the combined model then applied through use of a computer to each cell, resulting in a score for each. The outcome was a priority listing of acquisition sites.

The approach is also being used to develop a Natural Resources Plan for Bucks County.[illegible] The entire plan will consist not only of a land-use intensity plan based on a comparison of each planning cell's natural features, its sensitivity to development, but also a set of implementation policies and the integration of the Natural Resources Plan with other elements of the Comprehensive Plan. The Natural Resources Plan, still in the first stages, involves three major steps:[illegible]

> The first step in developing the Natural Resources Plan is to establish operational definitions for the various natural critical features of Bucks county. . . . Evaluation and weighting of critical natural features is the next step in plan development. Priorities for protection are established. . . . The last phase in plan development is the setting of priorities and targets. Major policy issues are tested. For example, one policy might be to protect the most threatened resources. A conflicting policy would be to protect areas where land values are low and the most land could be preserved for each dollar spent. Both are valid planning concepts. A weighting system can incorporate the two into a single plan which may be pre-tested by computer, whereas intuitive discussions of conflicting policy issues often lead nowhere.

Evaluation of Environmental Impact. In addition to testing the potential effectiveness of a plan, policy, or regulation, there is now a trend toward testing the environmental impact of alternatives. Most evaluation methodologies developed thus far are applicable at the project level and are not suited for the evaluation of a general plan such as a land-use plan. These methodologies focus on producing an information display matrix for the decision-maker.

The information display matrix approach is useful because, although models of the various environmental sub-systems have been developed in which the various elements of the single sub-system have been weighted in terms of importance to the system function, there is yet no accepted model available in which the relative importance of all the sub-systems has been determined.

To a certain extent, the relative importance will vary depending on the objectives of the given community involved.

Stage 5: Action instruments

The fifth stage of the guidance system planning process involves making a decision or choice among the alternatives which have been evaluated. It may be generally stated that no single tool is effective in and of itself. The essence of guidance system planning is the design of a series of action instruments which, operating in concert, create a new set of conditions and roles for urban development.

This discussion of land-use guidance instruments focusses on the control of the pattern of urban development centering on three fundamental objectives:

> (1) The control of the spatial location of development;
>
> (2) The control of the timing or sequence or development; and
>
> (3) The control of the spatial design characteristics at the site.

Spatial location and timing

> (1) To economize on the costs of providing municipal facilities and services and to maintain them at a high quality level;
>
> (2) to retain municipal control over the eventual character of development by preventing premature and sporadic building;
>
> (3) to maintain a desirable degree of balance among various uses of land;
>
> (4) to achieve greater detail and specificity in development reglation.

Overtime, these "needs" have remained valid although their circumstantial basis has expanded to include: municipal fiscal balance, equitable housing opportunity for all socio-economic groups, provision of adequate public facilities to insure public health, safety, and welfare, and more recently prevention of development where and/or when it would impact adversely on the environment.

Assuming that an environmentally sound land-use plan has been developed for the area, three general categories of implementation tools exist—zoning, taxation policies, and major public investments such as transportation, water, and sanitary sewer systems.

Innovating zoning

Innovation in *zoning* has been characterized primarily by the creation of new types of zones or districts. These include the following:

Large Lot Zoning—This zoning technique involves designating areas, which are deemed valuable for their natural resources, agricultural potential, or simply as open space, for very low density (minimum 1-5 acres) single family or agricultural use. This approach may be useful for areas difficult to service with public water and sewer in the near future and which would become environmentally degraded through high density development.

Exclusive Agricultural Zoning—The Village of Harristown, Illinois *Zoning Ordinance* states that [illegible]

> The Agricultural Zone is established as a zone in which agricultural and certain related uses are encouraged as the principle uses of land. The specific intent of the agricultural zone is to facilitate the long-term use of lands best suited to agricultural production by preventing a mixture of urban and rural uses which place unbalanced loads on agricultural lands and which may result in speculative or inflated land values which encourage the premature termination of agricultural pursuits.

Three comments on effective agricultural zoning should be made. First, the tax assessment policy on such land is a crucial factor. Too often, development pressure in urban fringe areas brings a rise in the property tax on agricultural lands, agriculture becomes uneconomical. Secondly, exclusive agricultural zoning is intended to promote agricultural activity. Therefore, it should be applied only to prime agricultural land if zoning is to be used, in fact, in keeping with the best and highest use doctrine. Thirdly. ". . . many farmers will resist such a zoning classification, unless reassured that their property will be rezoned when they want to sell at speculative values."

Conservation Zones — Borrowing again from Harriston, Illinois *Zoning Ordinance*,

> The Conservation Zone is established to prevent the construction upon or alteration of rural or natural environments which have natural conditions of soil, slope, susceptibility to flooding or erosion, geological condition, vegetation or an interreaction between the aforesaid which makes such lands unsuitable for urban development. Further, this zone is established to protect areas of the environment, that, if altered, would cause health or pollution problems and environmental degradation. The Conservation Zone will also insure adequate areas for future conservation and recreation pursuits. Certain agricultural uses would be permitted.

Conservation districts, sometimes called Natural Resource Districts, are intended primarily for conservation use alone although agriculture is often permitted. For example, the Coon Rapids, Minnesota City Code establishing a Conservation District cites the following permitted uses:

> (i) Outdoor recreational uses operated by a governmental agency or conservation group, homeowner or private association and facilities for making some useful to public or association.
>
> (ii) Open space areas connected with residential, commercial, and industrial planned unit development.
>
> (iii) Conservation uses including drainage control, forestry, wildlife sanctuaries and facilities for making some available and useful to public.
>
> (iv) Agricultural uses.
>
> (v) Nature study areas and arboretums.

A number of more specific, yet still conservation-oriented, zoning approaches and other development ordinances have been developed: flood-plain zoning, coastal plain zoning, wetlands zoning, stream-bank zoning, shoreland zoning, and steep-slope zoning (or hillside ordinances). Often a special use permit is required for any construction in environmentally sensitive areas or for types of development with a high impact potential. Special use permits allow for a greater degree of detail and flexibility in controlling the quality of development and its impact on the environment.

Taxation innovations

Innovations in *taxation policy* to control the timing and location of development have been closely related to attempts to establish and retain conservation and agricultural zones. The Southeastern Wisconsin Regional Planning Commission notes that:

> Under present Wisconsin Constitution and Statutory Law, the most satisfactory way to relieve the owner of lands zoned for exclusive agricultural or conservancy use from unrealistically high property assessment and taxation is to remove the development potential. This may be accomplished in one of three ways:
>
> 1. The property owner may voluntarily grant an easement to a local unit prohibiting development for a period of at least 20 years.
> 2. The property owner may voluntarily place restrictive covenants upon the lands enforceable by a governmental unit in perpetuity or for some substantial period of time.
> 3. A governmental unit may purchase the development rights.

Minnesota's "Green Acres Law" (Chapter 60, Extra Session Laws of 1967) authorizes the owner of agricultural land to receive a deferment on property taxes. Agricultural lands is assessed according to its market value given that use until it is sold or converted to urban use.

The Livingston County, New York Planning Board is now utilizing the "Agricultural Districts" Law enacted by the State in 1971, designated "to encourage continuance of a strong agricultural industry in the state and to discourage urban scatteration into good farm areas."

Pennsylvania's Act 515, passed in 1965, is based on the same concept of tax abatement or deferral. Act 515, however, differs from some other state's laws in that it is applicable to a wider range of natural resource areas than simply agricultural. Act 515 "enables certain counties of the Commonwealth to covenant with land owners for the preservation of land in farm, forest, water supply or open space uses."

Innovations in the area of *public investment* to control the location and timing of urban development have been characterized by an increased recognition and use of public utility and transportation systems to shape urban growth patterns.

The Metropolitan Council of the Twin Cities, Minnesota has adopted a "Diversified Centers" growth strategy. That portion of the *Metropolitan Development Guide* dealing with sanitary sewer states the following policy with respect to their use as a device to implement the growth strategy:

> —Phase interceptor extensions to promote orderly and economic development.
>
> —Extend interceptors into communities only when the residents are assured of governmental capability to provide a full range of urban services and to exercise adequate planning and control.
>
> —Prohibit extension of sewer systems into areas where development should not occur, such as flood plains, airport clear zones, major groundwater recharge areas, and areas designated for open space use.

Similarly, the *Development Guide* indicates that open space, transit and thoroughfares will also be used as means to implement the development plan.

Public investment plans

Two basic approaches to achieving an interface between public investment planning and land-use planning have been offered. The first, termed Framework or Development District Zoning, is more a technique for utilizing comprehensive capital improvement planning to control the location and timing of development than a zoning technique in the traditional sense emphasizing the segregation of incompatible uses. For example, Bucks County, Pennsylvania, as described previously, has proposed the use of development district concept. Four types of development areas are proposed: Urban, Development, Rural Holding, and Resource Protection.

Growth is encouraged in Development Districts not only through the provision of public services based on a five year program but also rezoning parcels in the area to more intensive uses. Only in Development Areas is more specific-use zoning applied. Rural Holding Districts are placed in a "wait-and-see" condition and would be re-evaluated periodically. Development in Holding Districts would be discouraged through several measures. Public services would not be extended for five years at least. Other effectuation measures would include large lot zoning (minimum 5 acres), lower tax assessments under Act 515 (previously discussed), prohibition of development on sites exhibiting unfavorable percolation, agricultural management and assistance programs for farmers in the area, and public education. Development would be discouraged or prohibited in Resource Protection Areas through resource protection zoning of critical areas, reservation by official map of protection areas to be acquired within three to five years, the purchase of development rights or easements, and other measures.

The second approach to coordinating public investments to control the location and timing of development is the use of a Development Timing Ordinance. Although this type of ordinance is not entirely new,[46] its recent revival by the town of Ramapo, New York has created a great deal of interest.[47] In 1969, Ramapo[48]

> amended its zoning ordinance to create a new kind of "special permit" use labeled the "Residential Development Use." Anyone wantto use land for residential development cannot do so without a special permit. And a special permit is granted only if standards are met for minimum facilities and services available to the new development. The required services include sewerage, drainage, parks or recreation, schools, roads, and firehouses. The ordinance sets up a point system of values assigned to these services. A special permit requires a proposed development to satisfy at least 15 development points. The town, for its part, is pursuing an overall development plan and a capital improvement program drawn from that plan. If services needed for residential development are missing, Ramapo proposes to include them within its 18-year program of capital improvements, of which the first six years are specified in a capital budget.

Spatial design characteristics

There are three basic ways to protect the environment by controlling the spatial design characteristics of development: the use of density zoning or planned unit development ordinances; the inclusion of critical environmental provisions in zoning, subdivision, building, or health ordinances; and the requirement of environmental impact analysis on proposed development as a prerequisite to the granting of rezoning, subdivision plat, or building permit.

Essentially, both density zoning and planned unit development offer the developer flexibility in designing the site as long as an overall density restriction and other requirements as for improvements are met. This flexibility offers the potential for promoting environmental quality since developmment may be clustered and sensitive areas retained as open space. Most density zoning or planned unit development ordinances require the submission of a site plan as a prerequisite to approval. Through site review, assurance can be made that the most optimum site design environmentally has been achieved. Bucks County has proposed a rather innovative addition to standards for cluster developments. Not only would density requirements be stipulated but so, too, would an open space ratio and an impervious surface ratio (a ratio of all surface area impervious to rain—buildings, parking areas, driveways, roads, sidewalks, etc. —to the gross site area).[49]

The third approach to site control is to require developers to submit an environmental impact evaluation on proposed development. Although where such a requirement has been adopted it is limited to a disclosure requirement only, it does tend to shift the ultimate responsibility for environmentally sound development practice to the developer.

The Rocky Mountain Center on Environment has proposed a Model Environmental Subdivision Regulation which would extend the impact statement requirement concept beyond simply disclosure. No subdivision permit would be granted unless the "Environmental Inventory and Analysis" was adequate and insured that the following provisions would be met:[50]

> A. Will not result in water pollution. In making this determination, they shall consider: the amount of rainfall received by the area, the relation of the land to flood plains, the nature of soils and subsoils and their ability to adequately support waste disposal; the slope of the land and its effect on effluents; the presence of streams as related to effluent disposal; the applicable health and water resources department regulations.
>
> B. Does have sufficient water available per lot, both physically

and legally, for the foreseeable needs of the subdivision or developement.

C. Will not cause an unreasonable depreciation of an existing water supply.

D. Will not cause unreasonable soil erosion or reduction in the capacity of the land to hold water so that a dangerous or unhealthy condition may result.

E. Will not cause air pollution. In making this determination, they shall consider: the elevation of land above sea level; land topography; prevailing winds or the absence thereof; local and regional airshed; increase in sources, or quantity of emissions, as well as quality of such.

F. Will not cause unreasonable highway congestion or unsafe conditions with respect to use of the highways existing or proposed.

G. Will not cause unreasonable burden on the ability of the local government to provide water, sewage, fire, police, hospital, solid waste disposal, and other services.

I. Will not have an undue adverse effect on the scenic or natural beauty of the area, aesthetics, historic sites or rare and irreplaceable natural areas.

J. Will not have an undue adverse effect on wildlife and their habitat, on the preservation of agricultural land, on human psychological-physiological dependence upon open space, and on the boundary-line defining urban land use from rural.

K. Is in conformance with a duly adopted master plan, land-use plan or land-capability plan.

Stage 6: Monitoring

The final stage in the guidance system planning process, feedback and monitoring, brings the process full circle. Evaluation of urban system performance is obviously necessary to maintaining an adequate information system for continuous planning.

The guidance system planning process depicted as the third front of innovation in land use-environmental quality planning remains a rather theoretical concept. Yet, to a certain extent, it is the organizing concept of much planning activity at the local level.

Notes for Paper 2

[1] See, for example: F. Stuart Chapin, Jr., *Urban Land-Use Planning* (Urbana: The University of Illinois Press, 1966); Ira S. Lowry, *Model of Metropolis.*

[2] J. Thomas Atkins, et al., *Huntington Environmental Planning Program* (Philadelphia: Department of Regional Planning and Landscape Architecture, University of Pennsylvania, 1972).

[3] Interview with Michael Pawlukiewicz, Environmental Planner, Department of Environmental Protection, Huntington, New York, November 24, 1972.

[4] Los Angeles Department of City Planning, *An Environmental Conservation Element for the Los Angeles General Plan,* Draft report (Los Angeles: Department of City Planning, 1970).

[5] California State Code, Title VII, Chapter 3, Local Planning.

[6] Los Angeles Department of City Planning, op. cit.

[7] Section 21151 of the Public Resources Code of California, as amended by Chapter 1433, Stats. 1970.

[8] Telephone Interview with Francis P. Bennett, Director Wayne County, Michigan Planning Commission, December 21, 1972.

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[11] Metropolitan Washington Council of Governments, *Natural Features of the Washington Metropolitan Area* (Washington, D.C.: Metropolitan Washington Council of Governments, January, 1968).

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[13] Ian McHarg, *Design With Nature*

(Barden City: Natural History Press, 1969).

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[24] Atlanta Regional Commission, *Chattahoochee Corridor Study*, Draft report (Atlanta: Atlanta Regional Commission, July, 1972).

[25] Lane H. Kendig, "Computerized Guidance System as Developed in Bucks County," presented at Confer-In-West, Annual Meeting of the American Institute of Planners, San Francisco, Calif., October 24-28, 1971, (mimeographed, available from The American Institute of Planners, 1776 Pennsylvania Ave., Washington, D.C.).

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[29] Henry Fagin, "Clinic: Development Timing," *Planning 1955* (Chicago: American Society of Planning Officials, 1955).

[30] Village of Harristown, Illinois, *Zoning Ordinance* (Harristown: Village of Harristown, 1972), section 3.1.

[31] Gunnar C. Isberg, "Development Problems in the Urban-Rural Fringe: Need for Unified Plans and Programs," Submitted for presentation at Confer-In 72, Annual Meeting of the American Institute of Planners, Boston, October, 1972.

[32] Village of Harristown, Illinois, op. cit., section 3.1.

[33] City of Coon Rapids, Minneosta Ordinance No. 378, "An Ordinance Creating a Conservancy District Designated (CD) and, Therefore Amending City Code Chapter 11-300," May 9, 1972.

[34] See: Chapter VII; and Jon A. Kusler and Thomas M. Lee, *Regulations for Flood Plains*, Planning Advisory Service Report No. 277 (Chicago: American Society of Planning Officials, February, 1972).

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[45] Bucks County Planning Commission, *The Urban Fringe: Techniques for Guiding the Development of Bucks County.*

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[49] Bucks County Planning Commission, "Proposed Amendment to Middletown Township Zoning Ordinance," unpublished (Doylestown: Bucks County Planning Commission, 1972).

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V.3 Impact statements: more myth than reality

Lyle J. Sumek *

Today, the provision for environmental impact statements is considered by many government officials as one of the most recently controversial environmental measures. The concept of assessing potential environmental consequences originated with the National Environmental Policy Act (NEPA) of 1969 which marked a dramatic shift in governmental policy and actions regarding the environment. In this act, Section 102 stated that federal agencies are required to prepare and use environmental impact statements (a detailed analysis of environmental factors within proposed action) in their agency's review process before they take any "major actions" including recommendations and reports on legislation which "significantly affect the quality of the human environment." [1] Since its enactment, many state and local governments have followed the federal example by adapting their own variation of environmental impact statements process. The purpose of this article is to assess the viability of at the federal, state and local levels, as a means of improving environmental quality.

I. The Federal approach

The provisions of NEPA have been compared in importance to the Full Employment Act of 1946, since it is designed to (1) bring about a national consensus and new direction for future development considering environmental quality and (2) modify and develop new decision-making processes considering environmental factors which were once neglected. In order to truly appreciate the significance of NEPA and the problems encountered in developing an assessment process, the legal requirements need to be briefly reviewed.

NEPA consists of three components:

A General Policy Statement was adopted which recognized that each person has a responsibility to contribute to the preservation and enhancement of that environment. NEPA orders all Federal departments and agencies to use all practicable means to improve and coordinate their planning, functioning and programming in order for the nation to achieve the following goals: (1) to fulfill the responsibility of each generation as trustee of the environment for succeeding generations; (2) to assure for all Americans safe, healthy, productive, and aesthetically and culturally pleasing surroundings; (3) to attain the widest range of beneficial uses of the environment without degrading or degradation, risk to health or safety or other undesirable or unattended consequences; (4) to preserve important historic, cultural, natural aspects of our national heritage and maintain wherever possible an environment which supports diversity and variety of individual choice; (5) to achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and (6) to enhance the quality of renewable resources and approach the maximum attainable recycling of depletiable resources.[2]

The Council on Environmental Quality (CEQ) was created for developing and implementing environmental policy. Although opposed by President Nixon, the creation of this new body was approved with little Congressional debate or opposition. The CEQ is located in the Executive Office of the President and is composed of three members who shall be appointed by the President to serve at his pleasure, with and by the consent of the Senate.

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Their primary funcions include (1) the advising and assisting of the President on the preparation of the annual report called the Environmental Quality Report, which is available annually from CEQ: (2) the gathering of information concerning the conditions and trends in the quality of the environment, and analyzing and interpreting this information with the purpose in mind of submitting to Presidential sudy relating to these conditions; (3) the reviewing and assessing of the various programs and activities of the Federal agencies to try to assure their consistency with the environmental policy declared in the NEPA; and, (4) the reporting to the President at least once a year on the general condition of the environment.[4]

The birth of the EPA

Although not created as a provision of NEPA, it is important to keep in mind the other agency of the Federal government which is responsible for environmental quality. The Environmental Protection Agency (EPA) was created December 2, 1970 in a reorganization of the executive branch, which entailed the consolidation of Federal programs dealing with air pollution, water pollution, solid waste disposal, pesticide regulation, and environmental radiation. The agency was first headed by William D. Ruckelshaus. Although EPA and CEQ are both concerned with environmental policy there is significant difference between the two. CEQ is in the Executive Office of the President and is responsible for policy advice, reviewing and coordinating environmental impact statements as well as environmental control activities of all agencies. The staff is small which limits their involvement in other agencies' activities. On the other hand, EPA as an operating line agency is responsible for administering and conducting all federal pollution control programs, focusing on pollution control as a strategy for securing environmental quality as well as preservation of wildlife and natural resources. In the environmental impact statement process, EPA functions like any other federal agency in reviewing statements.

The Environmental Impact Statement Process as outlined in NEPA was specifically designed as a way of assessing environmental consequences on proposals rather than a cursory exposition of agency intent or justification for the program. The intent is to have Federal agencies analyze their policy alternatives before actual decisions are made. The reason for including the action forcing procedure was the fear that in absence of such a procedure agencies might evade implementation of the policy. The remainder of this section will analyze how the impact process is being implemented.

Guidelines for impact statements

According to NEPA, the Council on Environmental Quality becomes the primary administrating body with the responsibility for developing explicit guidelines regarding the processes of preparation and reviewing of impact statements. On March 5, 1970, President Nixon issued Executive Order 11514, which outlined the implementation process for NEPA and clarified CEQ's role. In this Executive Order, the President stated that all Federal agencies' heads shall monitor, evaluate, and control on a continuing basis their agency's activities so as to protect and enhance the quality of the environment, to develop procedures to assure timely public information and understanding of Federal plans and programs with environmental impact in order to obtain the views of interested parties.[5] It also stressed that public hearings be used wherever appropriate and that the public be provided all relevant information on alternative courses of action. State and local agencies were encouraged to adopt similar procedures for informing the public concerning their activities effecting environmental quality. Finally, the Executive Order established the responsibilities of the Council on Environmental Quality, which includes (1) the evaluation of existing programs and policies of Federal agencies, to direct them toward the controlling of pollution and the enhancement of the environment and (2) the development of guidelines to the Federal agencies for the preparation of detailed environmental impact statements.

To standardize the process, CEQ issued general guidelines to Federal agencies on how to handle environmental impact statements that they must prepare. A major innovation was that draft statements must be made available to the public 90 days before an administrative action is taken, but not including proposals for, or reports on legislation. Final statements must be available for 30 days prior to such action for public comments on possible revisions.

On April 23, 1971, CEQ revised its guidelines integrating the requirements of Section 102 of NEPA and Section 309 of the Clean Air Act, as amended, which calls for public comment by the Administrator of EPA on proposed legislation, regulations or agency actions affecting EPA's areas of jurisdiction, including air and water quality, solid waste, pesticides, radiation, and noise. These revised guidelines applied to agency actions for draft statements circulated after June 30, 1971. All Federal agencies were asked to update their own procedures for writing and reviewing environmental impact statements which should be made available to CEQ for review prior to formal issuance. The points: (1) identifying types of agency actions requiring environmental impact statements, appropriate time for interagency consultations, and internal agency review process; (2) assuring advance comments from EPA; (3) including an adequate description of proposed action which will allow careful assessment by commenting agencies; (4) assuring to maximum extent practicable, the minimum 90 day periods of public availability for draft and final environmental impact statements, and, (5) allowing timely public information and understanding, which should include, where appropriate, public hearings and public access to draft and final environmental impact statements. However, in July, 1971, the U.S. Court of Appeals for the District in Calvert Cliffs' Coordinating Committee vs. AEC found that AEC had failed to provide for environmental review of cases in which a construction permit had been granted prior to NEPA's effective date, but an operating permit had not been granted at that time.[8] This ruling resulted in CEQ delaying the deadline for Federal agencies in submitting their guidelines so they could modify them in considering the court decision. As a result, it was not until November, 1971, that agencies' guidelines were submitted for CEQ and public review.

Goal: Self-implementation

The ultimate goal of the CEQ guidelines is to make the process of formulating Federal impact statements self-implementing, which means that environmental factors will receive proper consideration without court or CEQ intervention. However, achievement of the goal has been hindered by (1) the absence of a strong and comprehensive program to implement the delegation; (2) the fact that NEPA does not set forth any enforcement provisions to ensure compliance nor does it state that noncompliance is unlawful, and (3) a reluctance of agencies to modify their decision-making processes to incorporate the environmental impact statement process. The statement process so far has been one of reluctant implementation and cooperation. The courts have ended up playing the role of policing by determining whether agencies have fully and in good faith complied with the procedures. The result has been that the effectiveness of the environmental impact statement has depended upon the courts for elaboration and clarification through over two hundred court cases.

Today, the environmental impact statement process, as outlined in the guidelines and clarified in the courts, is complex, allowing departmental variation. A simplistic model of the overall process for developing an environmental impact statement is shown in Figure 1.

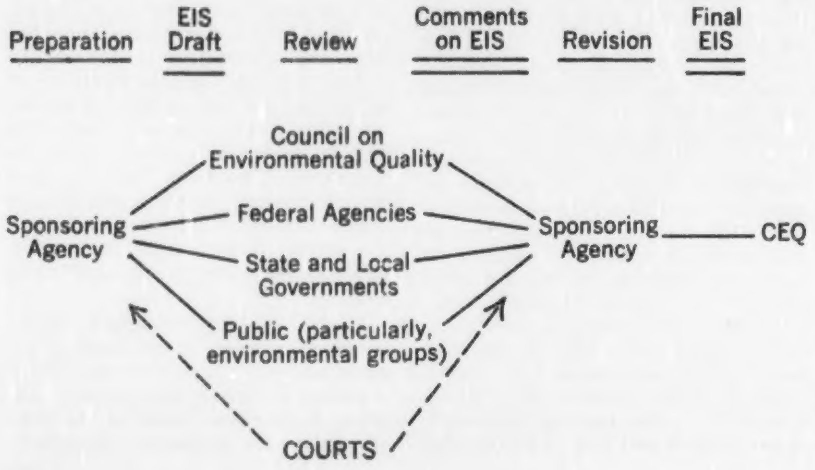
After a determination is made that an environmental impact statement should be written, the general process always consists of the preparation of a draft environmental impact statement which is then sent to CEQ, other Federal agencies, state and local governments, and public interest groups for review, with comments being sent back to the sponsoring agency where the draft environmental impact statement is revised and a final statement is issued. The courts, through their rulings on specific cases, have played an active role enforcing the procedural requirements of NEPA.

EIS requirements

To fully comprehend this process, one must begin with the decision to write an environmental impact statement. Under Section 102, all Federal agencies have a duty to implement the national policy and to consider in the development of policies and regulations, to the fullest extent possible, environmental matters. As part of this obligation, NEPA requires that an impact statement must be written for *major* proposals of legislation and other federal actions which may significantly effect the quality of the human environment. With the legislation using the terms "major" and "significant," many agencies have been able to exercise judgment in deciding the applicability of these terms in light of its knowledge of the nature and effect of its programs. This situation has resulted in much confusion over whether an environmental impact statement is required. During the first year and one-half, environmental groups brought many lawsuits against agencies forcing them to write environmental impact sttaements.[7]

Although there is some variation in many Federal agencies, a good example would be the Federal Highway Administration. It set forth the general criteria that statements must be drafted on all highways which are considered to be major actions and are likely to significantly affect the human environment, where organized opposition has occurred or is anticipated, and significantly affect historic or conservation lands. In defining what constitutes a major action, the guidelines stipulate that it includes any highway in an entirely or generally new location, or a

FORMULATION OF FEDERAL ENVIRONMENTAL IMPACT STATEMENTS



major upgrading of an existing highway requiring functional changes such as adding medians, widening a road from two to four lanes, and extensive right-of-way acquisition. A significant environmental effect includes whether the project is likely to have an adverse impact on natural, ecological, cultural or scenic resources, to be highly controversial regarding relocation housing resources, to divide or disrupt an established community or disrupt orderly planned development or is inconsistent with plans adopted by the community, and to have a significant detrimental effect on air, water and noise pollution. Other agencies are more specific, as demonstrated in the Federal Power Commission cutoff line for hydroelectric projects at 2,000 horsepower.

Pre-NEPA projects

In addition, many agencies have been confused over the requirement of environmental impact statements for activities begun or authorized before NEPA's enactment. Since NEPA contains no transitional language, the Council's guidelines tried to deal with this problem. If prior commitments, legal or financial, make it impractical to change the course of action, there should still be an environmental impact statement discussing the project's environmental effect and possibilities of minimizing adverse consequences from the remaining major actions. The retroactivity problem remains in the licensing of nuclear electric power plants. In the case of the Quad City Nuclear Power Station where construction was being completed on a project initiated before NEPA's enactment, the Atomic Energy Commission attempted to circumvent the environmental impact statement process by granting a partial operating license before a final environmental impact statement review of the application for full license was completed. The U.S. District Court for the District of Columbia in granting a preliminary injunction found that the issuance of a partial license constituted final agency actions requiring compliance with Section 102.[8]

Environmental impact statements are also required for certain environmental action by EPA authorized under environmental legislation. In the Kalur v. Resor decision, the U.S. District Court for the District of Columbia upset Federal antipollution programs relying on the government's right to issue permits for dumping of chemical pollutants into a nearby Grand River where Kalur goes canoeing. The decision prohibited the Federal government from issuing permits that shield polluters and potential polluters where Congress has specifically prohibited such activities. It found no merit in the Federal government's claim that environmental impact statements should not be required for issuance of pollution control permits.[9] EPA's position with regard to the requirements of Section 102, NEPA, were further clarified in the Federal Water Pollution Control Act of 1972. Section 511(c) exempts EPA from this obligation except for sewage treatment plant construction and for discharge permits for new sources.[10]

Timing of the EIS

A secondary question is when in the agencies' planning process should an environmental impact statement be written. According to CEQ's guidelines, environmental impact statements must be prepared early enough in the agency's review process to permit meaningful consideration of the environmental impact statements should come early in the agency's process in order to comply with NEPA, so that program formulation will be directed by research results rather than research programs being designed to substantiate programs.[11] This means that the agency must anticipate a minimum 90-day wait from the filing of the environmental impact statement to the initiation of action, which may be extended if the final environmental impact statement follows the draft by more than 60 days. If any revisions are required, the process may be extended even longer. It is important to note that these waiting periods do not apply to legislative proposals and reports and may be modified with CEQ consent under the following conditions: emergency circumstances, expense to the Federal Government, or impaired program effectiveness.

Drafting an EIS

After it determines that an environmental impact statement is required, the sponsoring agency prepares a draft statement using its own expertise and information. In the writing of statements, Section 102 requires that federal agencies must: (1) utilize a systematic interdisciplinary approach which will ensure the integrated use of natural and social sciences and the environmental design arts in planning and decision making which may have an ampact on man's environment; (2) identify and develop methods in consultation with the CEQ established by Title II of this Act to ensure that presently unquantifiable environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations; and (3) consult and obtain comments from other Federal agencies which may have jurisdiction under law or expertise with respect to the environmental impact, as well as Federal, state, and local agencies.

If two or more agencies are involved on the same project, one agency will be designated as the "lead" agency and assume responsibility for preparation and review of environmental impact statements. The designation of a "lead" agency is not as easy a job as it may look. For example, in the case of the Trans-Alaska Pipeline, the Department of Interior was the lead agency since it was the first federal agency involved when it granted the pipeline right-of-way permit across federal lands. However, if the pipeline had involved private or non-federal lands, it is not clear whether the Department of Interior or the Department of Transportation would have been the "lead" agency, since the latter department could have been involved on access roads and highways. The possible confusion lingers on.

State involvement

Unless the state or local law requires its own environmental impact statement, a state prepares an environmental impact statement only when its actions are supported by Federal contracts, grants, or permits, and the procedures of the Federal agency have delegated initial preparation of statements to the state level. For example, the Federal Highway Administration, in providing matching grants for many state highway construction programs, has the appropriate State Highway Department prepare the draft statements, but takes responsibility for the final statement. Here, and in other cases where the state or local government is applying for Federal funds, the applicant is asked to consider and evaluate the environmental impact of the project. This part of the application becomes the agency's environmental impact statement.

In general, every Federal environmental impact should contain the following elements:

(1) a description of proposed action—The description includes basic data concerning the project as well as existing and proposed land use and other existing environmental features.

(2) an analysis of the environmental impact of the proposed action—This evaluation emphasizes significant beneficial and detrimental environmental consequences upon the state, region, or community. The environmental impact considers such factors as anticipated increases in urbanization and displaceament of people.

(3) a discussion of adverse environmental effects which cannot be avoided should the proposal be implemented—This evaluation focuses on such problems as water or air pollution, effects upon land, damage to life systems, urban congestion, threats to health, or

other consequences adverse to the environment. Adverse effects include those which cannot be reduced in severity and those which can be reduced, but not eliminated, to an acceptable level. For the last two elements, courts have ruled that environmental impact statements must consider and balance opposing considerations. In the case of the Cannikin Underground Nuclear Test Committee For Nuclear Responsibility v. Seaborg, the U.S. Court of Appeals for the District of Columbia held that an environmental impact statement must inform the officials making the ultimate decision of the full range of responsible opinion on the effects of the proposal.[12] Therefore, a statement must set forth opposing views on significant environmental issues raised by the proposal. The Court stressed that it would be arbitrary and impermissible to omit from a statement any reference whatsoever to the existence of reasonable or responsible scientific opinion on such issues. What is required is a meaningful reference that identifies the problem at hand for the responsible officials. The significance of this decision is that the initiating agency is required to circulate a draft for comment, to discuss opposing opinion in an effective way to meld the best knowledge on the environmental issue, and consider all major schools of thought in the draft statement. If there are responsible opinions of which the agency is unaware, they can be brought out in comments on the draft.

(4) an analysis and consideration of alternatives to proposed action—The exploration of alternatives including an objective evaluation and analysis of the probable beneficial and/or adverse effects of each, including an alternative for no project at all or project termination. In National Resources Defense Council v. Morton, the U.S. Court of Appeals for the District of Columbia clarified recently the requirement of discussion of alternatives within environmental impact statements.[13] The agencies may not limit consideration of alternatives to alternatives which could be adopted by the agency issuing the impact statement, but rather must include the broad problem area and alternatives that could be implemented or developed by other agencies. The case involved the proposed sale of offshore gas and oil leases by Department of Interior, estimated in worth at $400,000,000. The Court enjoined the sale on the basis that the environmental impact statement did not adequately discuss alternatives to the proposed action. Particularly, agencies may not limit alternatives which could be adopted and put into effect by the official or agency issuing the statement. All reasonable alternatives must be discussed, including those which depend for implementation on legislative or executive action outside direct control of the agency. The environmental impact statement is not only for the exposition of thinking of the agency, but also for guidance of those ultimate decisionmakers and must provide them with environmental effects of both proposals and the alternatives for consideration along with various other elements of public interest. In this particular case, the opinion set forth the specific alternative possibilities for meeting the energy crisis which should be discussed in the impact statements.

(5) the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity—Short-term uses include construction, changes in traffic patterns, the taking of natural or manmade features, as compared to the long-term effects including foreseen changes in land use patterns, water and air quality, wildlife and other environmental factors.

(6) any irreversible or irretrievable commitments of resources involved—Most projects require use of natural resources, such as forest or agricultural land, which are generally insignificant quantities. A project may generate other related actions that could reach major proportion and which would be difficult to rescind. For example, a new highway project which would provide access to a previously nonaccessible area acts as

a catalyst for industrial, commercial, or residential development in the area.

In summary, a Federal environmental impact statement must be sufficiently detailed to allow an administrator to arrive at a reasonably accurate decision regarding environmental costs and benefits from program implementation. An adequate discussion of alternative proposals must allow for program modification during agency review in order to assure that their action will be in accordance with the goal in NEPA.

Reviewing the EIS

After a draft environmental impact statement is prepared, the sponsoring agency sends it out for review and comments by other Federal agencies which have a specialized expertise relating to the project and to state and local governments. Because of its small staff, CEQ may or may not comment. Their primary role has been to serve as a traffic coordinator for the flow of environmental impact statements, leaving most substantive comments to particular expert agencies. In an appendix to the CEQ Guidelines, there is a list of Federal agencies designating areas of expertise in a particular aspect of the environment which should be asked to comment. For example, in the area of urban planning the following agencies would be expected to have expertise and comment on the draft: Department of Transportation (Federal Highway Administration), Department of Housing and Urban Development, Environmental Protection Agency, Department of Interior (Geological Survey and Bureau of Outdoor Recreation), and the Department of Commerce (Economic Development Administration).

In addition, state, regional and local governments may be affected by the environmental impact statement. When necessary, copies of the draft environmental impact statement are either sent directly to that agency authorized to develop and enforce environmental standards or to the state, regional, or metropolitan clearinghouse set up by A-95, Office of Management and Budget. The scope of what actions are susceptible to state and local review is limited. Budget and legislation proposals are usually excluded from such local review.

Furthermore, the draft environmental impact statements must be made available to the public. Any individual, group, or organization may comment on the draft by expressing support or opposition, suggesting alternatives, or pointing out environmental effects which may have been overlooked. The comments may take a variety of forms —a letter, a critique or a "counter-102 Statement" setting forth views and analysis of the draft. Many Federal agencies encourage the involvement of environmentalists by securing comments directly from local or regional environmental groups such as the Sierra Club and the National Audubon Society. Some agencies, like the Federal Highway Administration, are required by law to hold public hearings. In addition, Executive Order 11514 encourages other agencies to hold them as a process to obtain public opinion. For non-regulatory hearings, the draft environmental impact statements must be made available at least 15 days in advance.

In general, Federal agencies must allow at least 30 days for comments, with 45 days for EPA comments on the project. Some agencies have found that this is insufficient time and as a result have written longer periods in their procedures for the review process. In addition, CEQ Guidelines suggest that requests for 15 day extensions should be considered favorably.

The final statement

After the comments are returned to the sponsoring agency, the information is used to modify the project, if necessary, and to prepare a final environmental impact statement. In the final statement, the agency must include copies of all comments received. It is the agency's responsibility to make comments available on request, with requests being directed at the agency's environmental liaison officer.

As of June 1, 1972, CEQ had received a total of 2,933 environmental impact statements, of which 1,552 were final statements. A breakdown by department of those which have frequent contact with local government follows: Department of Transportation, 1,696; Corps of Engineers, 438; Department of Agriculture, 188; and Housing and Urban Development, 34. By type of projects, the number submitted are as follows: roads, 1,436; watershed protection and flood control, 403; airports, 220; navigation, 186; electric power, 150; parks and wildlife refuges, 66.[14]

At the request of Representative Dingell (D-Mich), Chairman, Subcommittee on Fisheries and Wildlife Conservation, House Committee on Merchant Marine and Fisheries, the General Accounting Office (GAO) conducted a study to evaluate the implementation of Section 102, NEPA, and the adequacy of selected environmental impact statements. The GAO selected one impact statement from the following agencies: the Soil Conservation Service, the Army Corps of Engineers, the Reclamation Bureau, the Federal Highway Administration, the Forest Service and the Department of Housing and Urban Development. Although the GAO report indicated that these agencies were concerned about the environmental consequences of their programs and projects, it concluded in general that the usefulness of impact statements was impaired by:

(1) Inadequate discussion of, and support for, the identified environmental impacts which involved surface treatment of impact or, to an absence of indepth technical discussions of the consequences of proposed projects. Some conclusions were not substantiated with hard data and others were falsely or mistakenly reported. The impact of the projects was partially identified but the extent of the impact was not dealt with. There was also the tendency to completely ignore possible environmental consequences.

(2) Inadequate treatment of reviewing agencies' comments on environmental impacts which involved the failure of agencies to circulate their plans to other agencies about the proposed projects. Often, public views were either not solicited or were not adequately considered.

(3) Inadequate consideration of alternatives and their environmental impacts which involved not only the failure to conduct and/or report on indepth studies and to support conclusions reached with specific data, but also the failure to consider alternative proposals at all. The tendency was to merely state that one alternative was best and to leave it at that.[15]

In a similar study, an interdisciplinary team at the University of Colorado, under a grant from RANN of the National Science Foundation, reviewed and analyzed environmental impact statements through January 1972. They concluded that

> . . . The impact statement process as it is now being implemented in government decisionmaking is not a very effective tool in protecting the environment. Although two-thirds of the actions for which statements were prepared had adverse effects, the actions proceeded essentially unchanged. The EPA, which would appear to be an agency responsible for suggesting environmentally less damaging alternatives, did not comment in a majority of cases.[16]

NEPA circumvented

Thus, although the decisionmaking process has been opened up to consider environmental factors and to allow public participation, the implementation of Section 102 has not followed the procedural requirements of NEPA.

In addition, neither NEPA nor the 102 process dictates the agency's choice of a particular alternative. Courts have ruled that after an agency has met the requirements of NEPA the agency's decision, whatever it may be, is subject to limited judicial review afforded by arbitrary-or-capricious and substantial-evidence tests. Thus, agencies may initiate a project although significant environmental damage may result.

State and local approaches

The requirement of environmental impact statements for federally funded projects at the state or local levels has stimulated many states as well as local bodies to write or draft and pass legislation similar to NEPA. As of September 1972, ten states including Montana, Delaware, New Mexico, North Carolina, Washington, Wisconsin, Indiana, California, Arizona and Hawaii, had adopted some form of environmental impact statements at the state level. Arizona and Hawaii have adopted the requirements through administrative and executive orders, the other states through legislation similar to NEPA.

Although there are similarities in the provisions of the state requirements, there are some differences that are apparent. For example, in the state of Montana there is the Environmental Quality Council consisting of thirteen members, including representatives from the legislature, the public and the Governor's office. Their responsibilities include the development of guidelines for the preparation of impact statements as well as reviewing and commenting on Federal environmental impact statements. This Council is an arm of the legislature rather than of the executive branch, and oversees the functioning of executive agencies. It also acts as an ombudsman for the public, with statutory power enabling it to investigate on its own initiative or the public request to ensure compliance with environmental protection laws. In Wisconsin, the Bureau of Environmental Impact is responsible for investigating and evaluating the total impact of public and private projects on the environment. Arizona's Game and Fish Department is now required to complete impact statements prior to the construction of any large scale water development. Hawaii covers projects built on state land or with state funds and must be filed with the Office of Environmental Quality. In Indiana and North Carolina the law requires environmental impact statements to be filed with the Governor.

California was the first state to adopt environmental impact procedures and has passed legislation similar to NEPA. Several unique features exist in the California law including: (1) the sponsoring agency is responsible for paying for the preparation of the environmental impact statement; (2) an environmental impact statement must include mitigation measures proposed to minimize impact; (3) cities are required to make environmental impact reports on any project which may have a significant effect, and submit them to the local planning agency; (4) all state reviews of federal projects must be conducted under the direction of their law, which results in Federal agencies receiving more information than is required presently under NEPA; and (5) the state act makes all environmental impact statements falling under its jurisdiction available to the state legislature and to the public. Guidelines were developed by the Office of Planning and Research.

Private projects included

In the beginning, environmental impact statements were prepared by public agencies on only public projects. However, in the Friends of Mammoth decision (Friends of Mammoth v. Mono County), the State Supreme Court ruled that environmental impact reports were necessary for any private construction projection that requires a permit and that could, or will have a significant effect on the environment. This meant state and local agencies must develop, if they do not already have, processes for developing and reviewing environmental impact reports.

The Vermont experience

A different approach to assessing environmental impact has been taken by Vermont. In 1970, the state adopted a land-use law which gives the state the right to limit any development that could harm the environment. To enforce this right, the state requires all but small-scale developers to file an impact statement in the process of obtaining a building permit. It is the responsibility of the developer to demonstrate that his development will not cause undue damage to the air, overburden the water supply, or cause unreasonable soil erosion.

The state has created eight district commissions which administer the program and are responsible for (1) studying the impact of the proposed project on the water supply, soil, natural beauty, population, and transportation system; (2) asking developers to modify his plans in order to minimize potential environmental damages; (3) holding, if necessary, public hearings in which the developers, environmental groups, civic groups, and governmental officials may discuss the issue, and (4) granting or denying the building permit. The Commission will be assisted by the state's Environmental Conservation Agency which may also study the developer's application and may make recommendations to the local commission. If an application including impact statement are approved by the district commission a permit is usually granted within 60 days. An appeal can be made to the Vermont Environmental Board, and if necessary to the State Supreme Court. If the law is violated, the State can fine the developer $500 for each day of violation or imprisonment for not more than two years or both. So far, the effectiveness of the law has been hampered by (1) a lack of manpower to enforce the law, resulting in clearing and grading before applying for a permit, (2) insufficient guidelines for the developer in assessing potential environmental damage, and (3) weakening of the district commission when threatened with a lawsuit.

However, not all states feel that provisions similar to NEPA would be beneficial for them. They see the Federal process as ineffective and realize innovations are needed. During 1972, in the states of New York and Connecticut, the state legislatures passed some form of environmental impact statement similar to the provisions in NEPA. But they were vetoed by Governor Rockefeller and Governor Thomas J. Meskill. Although both governors were sympathetic to the underlying goal, their chief objection was to the confusion and to possible delays which might result from a requirement that all agencies file environmental impact statements before action is taken. In addition, the financial burden would increase since the implementation would require additional personnel and, in many cases, duplication of existing reviews.

City initiatives

With the requirement of impact statements by the federal government and by many states, cities have implemented or plan to implement some format of environmental impact statements, programs, and projects in their own agencies. Cities see the environmental impact statements as a meaningful way of incorporating environmental variables and values into a decisionmaking process. They feel that environmental impact statements will increase the quality of decisions made in that city.

One of the first cities to adopt environmental legislation was Inglewood, California, which adopted a policy of environmental impact studies for projects over $25,000 or smaller projects which could be grouped collectively to $25,000. Adopted on May 23, 1972, their ordinance recognized that every project will have some environmental effect and thus some assessment is required on every project. However, this assessment may involve only an initial review determining that the environmental effects will be insignificant and that no further study is needed. The process is as follows: (1) the environmental standards division must establish guidelines for preparation of statements; (2) the operating agencies and departments prepare an environmental impact study according to guidelines (these statements are prepared after preliminary design but before adoption of design budget or construction budget);

(3) the environmental impact studies are then reviewed by the environmental standards division which will confer with the operating department when revisions are necessary; (4) the impact study is reviewed by the planning division; (5) the city administrator reviews each statement and determines whether environmental safeguards are included in the project or if the environmental impact may be significant enough to warrant a public hearing. The environmental standards division estimated that environmental impact studies could be conducted. It was figured that less than one percent of the total project costs would be spent on conducting the environmental assessment. The environmental standards division also suggested on large projects, especially where the city had minimal expertise, that outside consultants be involved in writing and conducting the assessment.

Not all city officials or cities, however, look favorably upon the national program and its benefits, or see the necessity of creating their own procedure for writing environment impact studies. They have expressed concern over the efficiency of such a local program and the potential unnecessary delay it may cause in initiating needed projects in urban areas. They realize that at the present time it is hard enough to plan and develop a program and get city council approval without adding another step which would involve looking at how the environment is effected. Cities are, however, examining the question of whether they can develop some form of environmental impact statement process and are watching and analyzing the events both at the national and state levels.

EIS strengths and weaknesses

At the present time, it is quite apparent that the process of meaningfully assessing environmental consequences for projects is more myth than reality. The present strengths and weakness of environmental impact statements can be summarized as follows:

Strengths:

(1) Many public agencies have modified their planning processes to include environmental considerations previously neglected.

(2) The decisionmaking process in government has been opened to increased public scrutiny through the involvement of environmental and other interest groups in the impact statement process.

(3) As a result of having to write and review environmental impact statements many public agencies are developing their own technical staffs for dealing with environmental problems.

(4) Some projects which had the potential of being environmentally damaging have been stopped.

Weaknesses:

(1) The implementation of the environmental impact statement process has been inconsistent, with some agencies writing an excessive number of environmental impact statements, creating more paperwork and less assessment.

(2) The cost of environmental assessment places additional financial burden on public agencies since they need some financial aid to cover the costs of hiring additional personnel or private consultants.

(3) The quality of environmental impact statements has been hampered by a lack of technical knowledge on such questions as what is environmental quality? What should be included in a good environmental impact statement? What is the present condition of the environment?

(4) The time in writing and reviewing impact statements has increased the length of time for application approval, thus delaying many projects while others review and comment upon the environmental impact statement.

(5) Public agencies and environmental groups have emphasized more the procedural requirements than the substantive content of the statements themselves.

(6) There has been some lack of political and administrative support at the federal level as demonstrated by the enactment but non-implementation of the Environmental Quality Improvement Act of 1970 which would have developed CEQ's staff for the environmental impact statement process and the drive in Congress for exempting various agencies from having to comply with Section 102.

The trend toward more public agencies adopting some form of environmental impact statement is likely to continue. The potentiality of environmental impact statements for integrative public decisionmaking will be realized only if the weaknesses are overcome soon. If not, environmental impact statements will be even more a program justification than an environmental assessment.

Notes for Paper 3

[1] A more comprehensive analysis can be found in the author's doctoral dissertation, *The Politics of Federal Environmental Impact Statements.*

[2] Public Law 91-190, 4 U.S.C. §4321 et. seq., 83, Stat. 852.

[3] *Ibid.*

[4] *Ibid.*

[5] Executive Order No. 11514, 35 Federal Register 4247 (March 5, 1970).

[6] *Calvert Cliffs' Coordinating Committee* v. AEC, 449 F.2d 1109, 1113-4, 2 ERC 1779, 1781-82, 1ELR 20346; 03248 (D.C. Cir. 1971).

[7] *Scherr v. Volpe*, 336 F. Supp. 88, 888, 3ERC 1586, 1590, 2ELR 20068, 20070 (W.D. Wis. 1971) and *Natural Resources Defense Council v. Grant*, 3ERC 1883, 2ELR 20185 (E.D.N.C. 1972).

[8] *Izaak Walton League v. Schlesinger* (D.D.C. 1971).

[9] *Kalur v. Resor*, 335 F. Supp. 1, 3ERC 1458, 1ELR 20637 (D.D.C. 1971).

[10] Public Law 92-500.

[11] *EDF v. Corps of Engineers*, LR-70-C-203, (D. Ark. 1971) and *EDF v. Hardin*, CA 2319-70, (D.D.C., 1971).

[12] *Committee for Nuclear Responsibility v. Seaborg*, 3ERC 1126, 1ELR 20469 (D.C. Cir. 1971).

[13] *Natural Resources Defense Council v. Morton*, 3ERC 1623, 2ELR 20071 (D.D.C. 1972).

[14] U.S. Council on Environmental Quality. *Environmental Quality 1972.* (Washington, D.C.: Government Printing Office, 1972), pp. 248-249.

[15] U.S. General Accounting Office. *Adequacy of Selected Environmental Impact Statements Prepared Under NEPA of 1969.* Report to the Subcommittee on Fisheries and Wildlife Conservation, House Committee on Merchant Marine and Fisheries, 1972.

[16] Kreith, Frank, "Lack of Impact," *Environment* XV (January/February 1973), p. 30.

V.4 Fixed versus variable environmental standards

Robert Pikul *

The established nature and enforcement of environmental standards will have a far reaching impact on future socio-economic-environmental characteristics of geographical areas, availability and cost of energy, revitalization of urban areas, and overall quality of life.

Environmental standards have been and are being formulated by the U.S. Environmental Protection Agency, the states, and local governments for a variety of pollutants released into air, water, and land. The process requires consideration of items such as effects (health, economic, ecological), measurement techniques, current environmental levels, pollution sources, and the technology and economics of control. A variety of procedures based on legislative authority, technical problems. and administrative requirements have been devised and implemented by organizations responsible for development of standards.**

This paper provides a frame of reference for discussions of fixed versus variable standards and generally explores some potential social and economic consequences of allowing variable standards. It will be shown that effluent or emission standards particularly exhibit both fixed as well as variable properties based on parameters such as time, geographical area, and source category. variability in standards generally results from independent analyses of individual pollutants and individual source categories. Because of the vital issues related to the levels and nature of environmental standards, their variability should result from an explicit consideration of emission control strategies aimed at achieving well defined environmental quality goals.

The implications of variable standards are discussed within the context of the air pollution problem as a specific illustration.

The concept of fixed versus variable standards may be confusing because of the large number of parameters which affect proper interpretation. For example, the concept pertains to variability (or invariability) with respect to time, space, among source categories and within source categories.

Time variation

Variation in time could be represented by the point in time at which standards are to be achieved or the ability to vary ambient or emission standards over a relatively short period (e.g., seasonally, daily). A short time period is arbitrarily assumed in this paper to emphasize short term discretionary changes in standards based upon risks, suitable control techniques and profile of available resources compared to long term schedule of achievement fixed by law based upon perceived need for improving environmental quality. A general relationship between varying ambient levels and time-lagged controlled emissions is shown in Figure 1.

Space variation

This parameter refers to the possibility of allowing different standards in different geographical areas, in recognition of social values, geographical and climatic differences, and population density. It includes the option of allowing one level of power-plant emissions in a municipality, a different (e.g., less stringent) level within a parent county and still another level on a statewide basis. It also includes the option of promulgating different standards for different sections of the country.

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*Presented by Robert Pikul, MITRE Corporation, at the National Conference on Managing the Environment.

Variation among sources

Variation among source categories applies to emissions or discharges allowed for various emitter categories which emit the same type of pollutant (e.g., steam electric generating plants, sulfuric acid plants). The EPA has prepared effluent guidance documents for twenty-one industries under the 1972 Federal Water Pollution Control Act,[35] which identifies twenty-seven industries for which effluent guidelines must be prepared*.

The EPA believes that guidelines are required for an additional fifteen areas*. According to these guidelines, discharges are generally fixed in time and space. For a specific pollutant, however, they vary among defined categories of sources.

Variation within categories

This parameter allows for the possibility of different emission or discharge levels for specific selected sources within a category. Limitation of sulfur dioxide emissions per unit energy from a specific power plant, for example, would be allowed to differ from that of other power plants in a given locale, based upon plant characteristics such as age, boiler type and stack size. An illustration of this variability applies to the effluent guidelines mentioned above since they are meant to apply to the most significant polluters.

Variation by use

When considering water pollution, a major element affecting variation of standards is use of the water receiving the effluent.

Uses generally conform to the following categories: public water supply; industrial water supply; propagation of aquatic life; or water contact recreation. Not ony do standards for a particular pollutant vary among use levels in different geographic areas, but the use levels themselves vary from state to state. For example, Illinois at one extreme has defined only two use categories, while Missouri has defined seventeen.[36,37] Water quality standards are fixed in time once they are implemented, but vary over geographical areas and by use. For example, as applied to the pulp and paper industry, the fecal coliform tests associated with pathogens in the effluent are generally limited to 1000 organisms per 1000 milliliters of water. A reduced concentration must be achieved, however, if receiving waters are used for shellfish harvesting or contact recreation sports.

Ambient and emission standards

Primary ambient standards to safeguard the public health and secondary ambient standards to safeguard public welfare were promulgated in April, 1971, for six primary air pollutants: sulfur dioxide, total suspended particulates, hydrocarbons, nitrogen dioxide, carbon monoxide and total oxidants. The effective date for achievement of primary standards has been set for 1975, and for secondary standards a reasonable time

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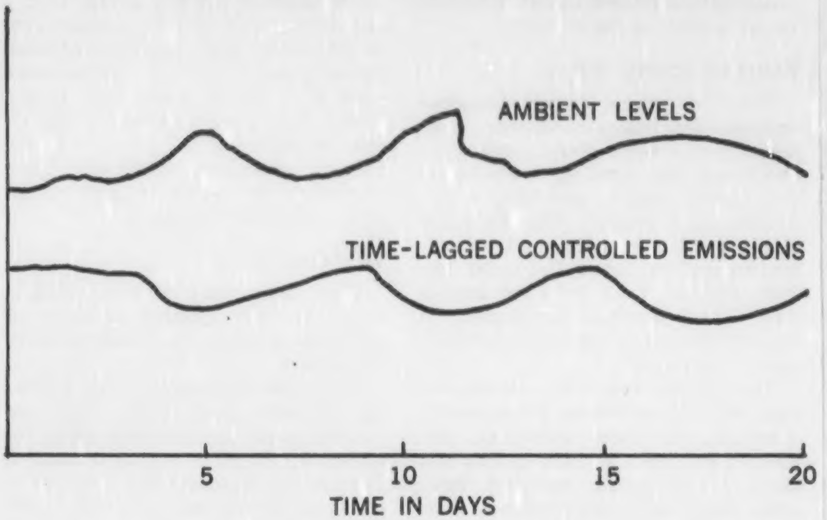
* The industrial categories for effluent guidance according to 1972 Federal Water Pollution Control Act are the following: canned fruits and vegetables, canned seafood, cement manufacturing, dairy products processing, electroplating, feedlots, ferroalloy manufacturing, fertilizer, glass and asbestos, grain mills, inorganic chemical manufacturing, iron and steel manufacturing, leather tanning meat products and rendering, nonferrous metals, organic chemicals manufacturing, paperboard and builders paper, petroleum refining, phosphate manufacturing, plastics and synthetics, pulp and paper mills, rubber processing, soap and detergents, steam electric power, sugar processing, textile mills, and timber products.

* These additional categories for which the EPA feels that effluent guidance is required are as follows: beverages, cane sugar, coal mining, fiberglass insulation, fish hatcheries, metal ores, motor vehicles, natural gas liquids, paints, pesticides, petroleum drilling, pharmaceuticals, photo processing, sand and gravel, and water supply.

FIGURE 1.—ILLUSTRATION OF TIME-VARIABLE EMISSION STANDARDS



thereafter. Ambient standards are fixed in time and space. Former EPA Administrator William D. Ruckelshaus has indicated that the Clean Air Act does not allow for increase of the health risk upon which the primary standards were formulated.[18] Changes to allow regional variability must be achieved through legislative action.

In contrast to the fixed ambient standards, emission limitations on stationary sources have been set according to State Implementation Plans (SIP's) and vary from state-to-state, among source categories and, in some instances, in time. Arkansas, for instance, allows the burning of any quality fuel as long as ground level ambient standards are not exceeded. Hence, emission standards are implicit. Although any generalization in this regard is hazardous, one might interpret this to mean that emissions could be allowed to vary during different periods of ventilation and assimilative capacity of the atmosphere as long as ambient standards are not violated. On the other hand, Alabama has an Implementation Plan which specifies .72 percent sulfur content for all coal burned and 1.08 percent sulfur for residual fuel oil. New source performance standards for utilities burning oil have been set at .72 percent.[8]

Section 202 of the Clean Air Act specifies that emission of carbon monoxide and hydrocarbons for light duty engines and vehicles manufactured in 1975 be reduced to ninety percent of levels for engines manufactured in 1970. The limitations are the same for nitrogen oxides emissions for vehicles manufactured in 1976, based on levels emitted by engines in 1971. Recently, the EPA Administrator granted a one-year extension for implementation of these standards. These limits, expressed in grams per vehicle mile, will be fixed in time for all sections of the country.

Emission standards for new stationary sources have been promulgated for various pollutants as they apply to Group 1 industrial categories (see Table 1). Standards are being developed for sources in Groups 2 and 3. Other groups may be considered to include sources such as gas turbines, lime plants, grain milling, auto assembly plants and petroleum, refineries. It is likely that these standards may be fixed

TABLE 1.—*New source performance standards*

	Source
Group 1	Steam Generators >250 Million BTU/hr.
	Incinerators
	Portland Cement
	Nitric Acid Manufacture
	Sulfuric Acid Manufacture
Group 2	Asphalt Batch
	Petroleum F.C.C.
	Rendering Plants
	Brass and Bronze
	Basic Oxygen Furnace
	Sewage Incinerator
	Secondary Lead
Group 3	Non-Ferrous Smelters
	Aluminum Reduction
	Kraft Mills
	Coking Plants
	Phosphate Reduction
	Phosphorus Reduction
	Animal Feed Defluorination
	Ferro-alloy Plants
	Coal Cleaning Plants

in time, space, and within source category (e.g., 0.8 pounds of sulfur dioxide per million BTU for liquid fossil fuels and 1.2 pounds of sulfur dioxide per million BTU for solid fossil fuels burned in all affected new steam generating plants), but variable among categories, for a particular pollutant. While total emissions from a given emitter may vary because of size of the emitter, emission rates are likely to be fixed.

Hazardous pollutant emission standards for mercury, asbestos and beryllium have been developed with reference to specific source categories and have similar space, time and source variability characteristics as new source performance standards. In the future, standards may be developed for other selected hazardous pollutants.*

Variability characteristics

The preceding discussion emphasizes that the interpretation of the concept of fixed versus variable standards is complex because one must consider the various types of standards, the environmental medium, and time, space, source category and use-level parameters. The pervasiveness of environmental standards will have a significant impact on all major industrial sectors of the country and related economic and social activities. The examples of air and water standards are sufficient to illustrate this point. A summary of the present situation based on the preceding illustration is shown in Table 2. The designation of fixed (F) or variable (V) represents major indications rather than clear, unambiguous extremes. This summarization provides a frame of reference for discussion in the following sections. Within this frame of reference, only the ambient standards and mobile source emission standards may be characterized as fixed.

Objections to variable standards

Consideration of variable standards might allow some flexibility in balancing risk of exposure with potential economic, technical and social effects of implementation of control technology. In addition, a control strategy which would permit variable emission standards (e.g., selective or intermittent controls) within source categories designed to meet ambient standards might provide some less stringent requirements for specific sources, with no deterioration in environmental quality. The issues are particularly important in cities with older housing and industries where implementation of fixed standards on a uniform basis might create significant dislocation and inhibit opportunity for economic and socially viable renewal and growth.

Reasons offered against adopting variable standards are discussed below.

Inequitable treatment

This is an important concern to the individual emitter who is controlled

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* These selected potential hazardous pollutants are: cadmium, arsenic, polychlorinated biphenyl, nickel, polycylic organic matter, aeroallergens, reactive organic, pesticides, radioactive material, vanaduim, manganese, chromium, selenium, chlorine, hydrochloric acid, copper, zinc, boron, barium, tin, phosphorous, and lithium.

TABLE 2.—*Fixed vs. variable standards and guidelines for air and water media.*

Medium	Standard/Guideline	Time	Space	Among Space Categories (Unit Rates)	Within Source Categories (Unit Rates)	Use
WATER	WATER QUALITY	F	V	—	—	V
	EFFLUENT DISCHARGE	F	F	V	V	V
AIR	AMBIENT	F	F	—	—	—
	STATIONARY SOURCE EMISSIONS (SIPs)	F	V	V	F	—
	MOBILE SOURCE EMISSIONS	F	F	—	—	—
	NEW SOURCE PERFORMANCE	F	F	V	F	—
	HAZARDOUS POLLUTANTS	F	F	V	F	—

F = Fixed
V = Variable
— = Not Applicable

more stringently than a neighboring or distant competitor. His costs, theoretically, are higher, and he has a disadvantage in the marketplace. This is a valid concern, but on the other hand, the concept of equity ought to be viewed more broadly to include external costs of environmental damage. If specific emitted *A* degrades the environment more severely than emitted *B*, thereby imposing greater social and economic burdens on society, one can argue that *A* ought to pay more than *B* to improve the situation (given that society dictates that the situation must somehow be improved). It is not clear, without additional analysis, which alternative is preferable from a societal point of view.

Another aspect of this issue involves the equitable allocation of allowable air polution emissions among and within specific emitter categories. One approach is to set an ambient air quality goal and to allocate emission rates in a localized area based upon the ambient effect of these emissions, so that the desired air quality goal is achieved, or surpassed. The similarity in the structure of the problem confronting economic decision makers in setting fiscal policy to environmental decision marking is illustrated in Table 3.[14]

TABLE 3.—*Similarity in the structures of environmental and fiscal parameters.*

Structural Element	Environmental	Fiscal
Goals	Achieve ambient standards	Balance Budget, maintain high income and employment
Mechanism	Flexible emission rates	Flexible and graduated tax rates
Safeguards	Non-degradation	Debt retirement
External Influences	Variation in assimilative capacity of environment	Variation in GNP

Allocation of emissions, implied by allowing variable emission standards, is in some ways analogous to allocation of block grants for public assistance. Questions concerning how to set the maximum emissions (aggregate amount of assistance) and how to distribute the emissions (grants) are similar in each case. James A. Maxwell[14] suggested in 1955 that the distribution of the national aggregate in the form of block grants be set on the basis of minimum per capita expenditure. A standard effort for each state would be defined as a percentage of the income payment raised and spent by the state. Poor states would not reach the per capita standard and would receive federal grants to meet the minimum goal. Some wealthier states may receive no supplementary federal grants. In this example, the question of equity is based not on differences in amounts of federal grants received by different states but on a minimum national per capita expenditure for public assistance for all citizens.

The problems of environmental policy and standards are relatively recent national issues compared to the problems of fiscal and economic policy. Environmental problems require an understanding of the natural sciences and technology, utilizing fundamental principles of chemistry, physics and biology. The preceding discussion suggests that they also include allocation considerations which economic and fiscal policymakers have been confronting over a longer period of time. Personnel from these disciplines could provide a fresh perspective for the scientifically oriented environmentalists in the formulation of environmental standards.

Complexity and costs

Some people argue that variable standards are more complex to adminster and enforce than fixed standards. Yet, one should consider whether the benefits of variable standards (e.g., in regard to degree of environmental quality achieved, greater availability of low-sulfur fuels, overall operating costs, economic dislocations) are greater than for fixed standards and if these benefits outweigh potentially higher administrative costs. Our federal tax structure is inequitable, in an absolute sense, and highly complex; yet, according to figures from the Internal Revenue Service, administrative costs amount to only 0.5 cents on each dollar collected.[38] This is not to say that they could not be lower if a less complex tax structure were adopted. Administrative costs do not appear to be the overriding issue associated with overhauling the tax structure. Voluntary compliance is an important reason for low administrative costs of the tax collection. This technique could also be employed in enforcement of emission standards. It has yet to be demonstrated from a cost-benefit point of view that administrative costs would eliminate consideration of variable environmental standards.

National economy

American compaines have manufacturing facilities in many parts of the country and sell their products in national and worldwide markets. If motor vehicle emission standards varied from state to state, this would require that the manufacturers adopt a variety of control devices to meet the different standards. Assuming these devices were developed and performed effectively, it would probably not strain the industry's ingenuity to include another option in the assembly process. The combination of options already offered are in the thousands, and multiplying these by a factor of four or five should pose no serious problems. But, relocation by individuals from one section of the country to another would constitute significant problems in insuring that their vehicles met local standards. The monetary cost of retrofit to the motorist could be significant, in addition to the inconveniences likely to be encountered.

Impact of variable standards

What are some of the impacts of fixed versus variable standards? The national ambient standards for six primary air pollutants are designed to protect the public health and welfare. Questions have been raised concerning the values of the standard with respect to health risk. They may be changed as more health effects data become available, but variation on a geographic basis would require a change in the law.

A specific example of the drastic measures proposed to achieve the fixed ambient standard of oxidants * applies to the South Coast Air Basin which covers a major portion of South California, including most of Los Angeles County.[4] In 1970, this standard was exceeded in some locations on 250 days. Ten percent of the readings taken in the basin were .40 parts per million. There is a serious problem in achieving the ambient standard. Uncontrolled emissions of reactive hydrocarbons, a major precursor of oxidant formation, is forecast by the EPA to be 691 tons per day in 1977. In order to meet the oxidant standard, EPA estimates that emissions must be reduced to 160 tons per day. A variety of controls have been proposed to meet this goal, the most dramatic of which involve a reduction of over eighty percent in vehicle miles traveled during critical periods from May to October. A mechanism to achieve this reduction would rely on rationing of gasoline by as much as eighty-two percent. Other actions would involve: (a) installation of retrofit de

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*160 $\mu g/m^3$ or .08 part per million for a one hour period not to be exceeded more than once per year.

vices on all 1955 and newer vehicles (in 1972, there were about six million such vehicles in the area), (b) annual inspections, and (c) conversion of all 1971-1974 light and heavy duty vehicles in fleets of over ten cars to use gaseous fuels.

The economic impact and social impact of the proposals would include: increased cost to vehicle owners ($200-$400 capital and $5-$15 annual maintenance) with particularly severe impact on low income groups; increased reliance on car-pooling and public transit; reduced mobility; potential loss of income due to decreased mobility; economic curtailment of automotive service and supply facilities; changes in property values; reduced taxes; and potential development of effective rapid transit.

The total extent of these impacts are yet to be analyzed. Under the present provisions of the Clean Air Act, the ten million people in this section of the country face a severe change in their current life style, as well as a drastic reduction in the economic viability of the area.

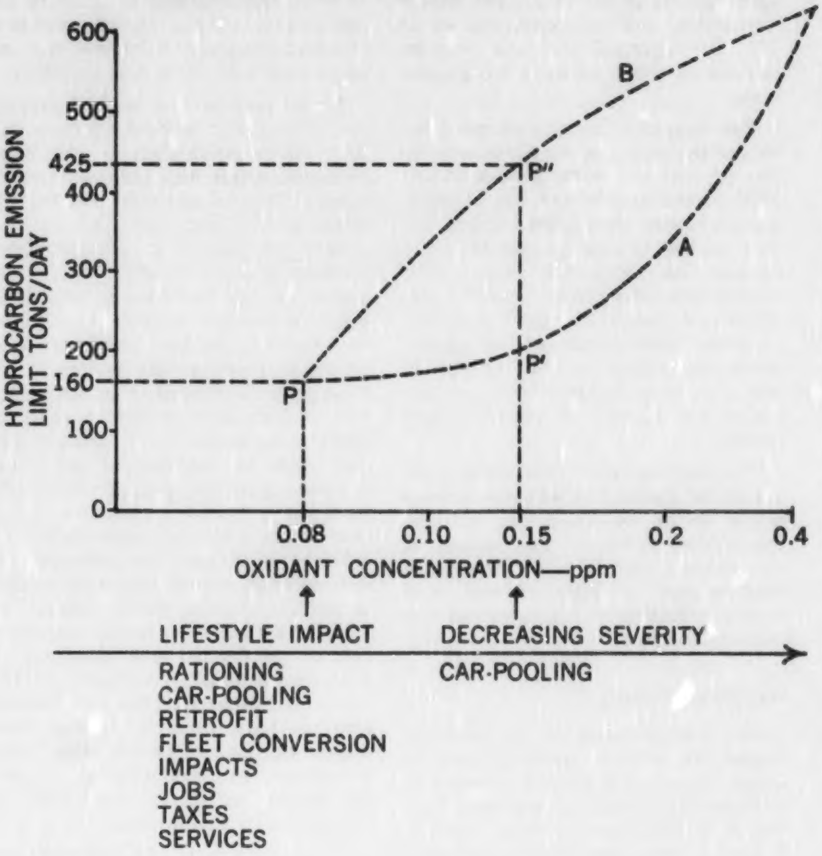
Weighing impacts

One can speculate on the potential impact that variable ambient standards might have on this kind of a situation. A higher limit might be less restrictive, but it is not clear by what amount. Figure 2 shows two hypothetical relationships between hydrocarbon emission limits and oxidant concentrations. The EPA has estimated that at .08 parts per million, the emissions must be at most 160 tons per day (point P, Figure 2). Beyond this point, curve B indicates a more favorable emission allowance than curve A. If one were contemplating raising the oxidant standard from .08 to 0.15 parts per million, then the emission limit would be 200 tons per day if curve A described the situation (point P′), and would be 425 tons per day if curve B did (point P″). One might conclude that the increased risk represented by increasing the standard buys little relief under curve A, but provides significant relief under curve B. It would be desirable to quantify the risk as a function of the concentration to arrive at a proper balance of risk and impact and cost of limiting emissions.

Let us examine that curve B prevails and that at 0.15 parts per million oxidant concentration there is little more noticeable effect than increased eye irritation. It is conceivable that the citizens in the area may opt for the greater risk associated with the higher standard in order to suffer a less severe curtailment on limitation of emissions. While a detailed analysis is required for obtaining precise quantitative estimates, it is safe to say that most adverse impacts (related to emission controls) listed above would be reduced. Suppose the limit of 0.15 parts per million might be achieved by increasing car pooling by fifty percent; this might represent a far more attractive option than living with the consequences of achieving a .08 parts per million standard. As long as great uncertainty exists concerning precise health effects of various concentration levels, consideration of variable ambient standards on a geographical basis has some merit. No one would argue that the Los Angeles area has had acceptably clean air over the last thirty years. On the other hand, the general area has attracted ten million people and offered some form of satisfaction of human needs.

People have long accepted risks associated with the automobile. Former Administrator Ruckelshaus has reported that eighty-five percent of the people surveyed in an opinion poll indicated that the consequences and risks related to the automobile — displacement of homes and business by highways, air pollution, noise, congestion, two million deaths and tens of millions injured in this country—was worth the freedom of mobility. Perhaps the people in southern California may feel that they would prefer to preserve a significant portion of that freedom at the expense of relaxing the air quality standard.[18] Any such choice made by people in this

FIGURE 2.—ILLUSTRATIVE RELATIONSHIPS—HYDROCARBON EMISSIONS VS. AMBIENT OXIDANT CONCENTRATION



area has to consider its impact on the people outside this area.

Allowing a choice

Acceptance of variable standards in different geographic areas might allow people to make a choice regarding where they may want to live, based on a consideration of risk associated with air quality and other economic and social factors. Apparently, however, envirnnmental awareness does not yet play that prominent a role when people choose their residence. Financial constraints and economic opportunities probably are more significant factors. As pointed out in a recent report of the Arvisory Committee on the Biological Effects of Ionizing Radiation," . . . the annual difference in natural radiation between a location in Louisiana and one in Colorado might be 100 mrem or more. Even a person who knows this probably does not take this difference into account in deciding to change his residence.

An adverse impact of allowing variable ambient standards might be to drive industry into geographic areas allowing higher (numerical) standards.

These areas are likely to be dirty and heavily populated. This would occur particularly if standards in a given area were set to allow degradation of the current ambient levels. To prevent areas with severe air pollution problems from getting worse, and to discourage industries from seeking air pollution control havens, a non-degradation limit with respect to current ambient air quality might be imposed.

In new town development areas, more stringent ambient standards might be promulgated on the basis of utilization of feasible new technology (e.g., emission controls, waste heat utilization, reclcying) which might be planned, designed, and applied at the beginning to achieve a high level of environmental quality.

Stationary sources

Stationary source emission standards tend to be variable among source categories, but fixed among emitters within a specific category (Table 2). Emission standards and regulations should be set on the basis of achieving an ambient level goal. Emission regulations prepared by the states attempt to achieve ambient standards throughout an Air Quality Control Region, based on the monitoring site having the highest ambient value in the Region. All emitters within a combustion source category, for example, must burn fuel in order not to emit more than a maximum amount of sulfur per million BTU. This tactic often results in severe restrictions on some emitters who contribute relatively little degradtion to air quality levels. In older urban areas, this may arbitrarily impose severe economic control costs on some plants. This may result in the abandoning of industries and residential apartment areas, creating hardship among the lower and middle income groups. Secondary effects may include intensifying social unrest in the form of increased delinquency, crime, and dereliction. A combination of allowing flexible ambient standards with more selective application of controls may allow these areas to be economically and socially maintained.

The implementation of variable emission standards is interrelated with strategies for emission controls that employ two types of strategies—fixed and intermittent.

Fixed strategies

Fixed strategies in pollution control consist of techniques such as process modification, time variance in implementation of regulations, and selective control of sources whose emissions constitute the greatest degradation to ambient air quality.

The results of several studies tend to support greater flexibility in emission standards and application of control strategies. Plotkin and Lewis have compared the application of uniform emission standards to source categories with a least-cost selective control strategy for the St. Louis Airshed.[17] The least-cost approach achieves a minimum cost of control by applying the most stringent controls to sources which contribute most to air quality degradation or whose marginal control costs are low, or both. The uniform emission control strategy, according to the analysis, would cost $10.4 million annually while the least-cost strategy would cost $6 million. The ground level concentrations for the least-cost strategy were higher than for the uniform emissions strategy. The additional benefits of uniform controls were not computed to relate them to the additional $4.4 million annual cost. Additional analysis performed by the EPA recently for the St. Louis area indicates a cost reduction factor of 3 to 6 for selective control (with respect to fixed emission standards) depending on the emission level.[11] Results of a study for three Air Quality Control Regions conducted by Krajeski and Yeager,[8] show that seventy-five percent effective control applied to a relatively small number of emitters on a selective basis would result in achievement of the primary sulfur dioxide standard (Table 4). For example, control of 300 emitters at seventy-five per-

TABLE 4.—*Summary of selective control strategy applied to three AQCR's*

AQCR	No. of emission sources	No. of emitters controlled at 75% effectiveness	Percent of emissions requiring control
New York	1,285	300	64
Philadelphia	700	53	19
Niagra Frontier	541	17	27

cent effectiveness in the New York area reduces overall emissions by sixty-four percent and achieves the ambient level at all receptors (Table 5). All emissions requiring control are combustive in origin. Since the New York area may be using five million tons of coal and 215 million barrels of residual fuel oil annually, less stringent emission controls on thirty-six percent of the fuels would provide a substantial contribution in reducing projected clean fuel deficits. These savings in clean fuel might be extended on a national basis. Moreover, allowing variability of extent of controls within and among source categories might allow even further economies.

Another alternative to allow more flexibility in emissions has been a proposed emissions tax. Many investigators have examined the implication of an emission tax which, if set at a proper rate, would provide an incentive to minimize operating costs and reduce emissions. Tax revenues could be applied toward developing better control technology and alleviating damage costs.[7, 12, 19, 22, 28]

Increased flexibility might allow most areas in the country to achieve clean air standards with minimal imposition of economic and social dislocation.

Intermittent strategies

Air quality is generally a function of emissions, assimilative capacity of the environment, control strategies and background levels. The dynamic interplay of these parameters constitutes an intermittent control strategy. Examples of these include,[28] load switching (e.g., drawing power from outside an area which is experiencing low assimilative capacity); work pattern modification (e.g., staggering of work schedules); and fuel switching (by sulfur quality or by type, i.e., coal to oil).

Criteria for evaluating intermittent control systems, based on meteorological conditions have been developed by EPA.[15] Fuel and load switching strategies (seasonally, daily) to minimize use of low-sulfur fuels while still achieving ambient standards have been described in several studies.[1, 8, 15] The Tennessee Valley Authority has had experience in investigating applications of fuel and

TABLE 5.—*Selective reduction of SO_2 emission to achieve $\mu g/m^3$ New York AQCR*

Emitter category	Present sources	Emissions tons/day (A)	Uncontrolled emissions from sources requiring control at 75% Sources	Uncontrolled emissions from sources requiring control at 75% Tons/day (B)	Total controled emissions Sources	Total controled emissions Tons/day (C)
Industrial Combustion	106	238	14	111	106	155
Industrial Process	42	79	0	0	42	79
Utility Power	31	1,389	21	1,039	31	610
Area Sources	1,106	2,020	265	1,248	1,106	1,084
Total	1,285	3,726	300	2,398	1,285	1,928

$C = .25B + (A - B)$

load switching techniques based upon meteorological conditions at the Paradise Steam Plant. Development costs were estimated at $262 thousands and annual operating costs were estimated at $103 thousand.[19, 20]

E. A. Ward has made a gross estimate of the national impact of applying a fuel quality switching strategy[20] (i.e., switching from low-sulfur to high-sulfur content coal or low-sulfur to high-sulfur oil during days of good ventilation or high assimilative capacity). An analysis of Air Pollution Potential Advisories issued by the National Weather Service indicates that eighty percent of time it would be possible to burn high-sulfur content fuel because the assimilative capacity of the atmosphere is high. In 1970, steam electric plants consumed 328 million tons of coal and 287 million barrels of oil. About two-thirds of the total power generated from plants which burned coal (either exclusively or in combination with gas or oil), was generated by plants which burned coal exclusively. It may be possible, therefore, for power plants to burn as much as

$$(328 \text{ x } 10^{6})(\tfrac{2}{3})(.8)=176 \text{ million tons}$$

of high-sulfur coal based on 1970 consumption. Because of concentration of plants in populated areas, low-sulfur coal must probably be burned even on some days with good ventilation in order to achieve ambient standards. Even if twent-five percent of this estimate is realizable, it would save about forty-four million tons of low-sulfur coal out of a projected deficit ranging from under 100 million up to 250 million tons. Assuming a price differential of $5 per ton between low-sulfur and high-sulfur coal, this represents a fuel cost savings to the utilities and to consumers of about $220 million annually.

Saving low-sulfur oil

About thirty percent of the total generating capacity of plants which burn oil is generated to some extent by plants which burn oil exclusively. A similar analysis as the one described for coal, above, indicates a maximum potential of burning seventy-million barrels of high-sulfur oil on good ventilation days. Assuming that twenty-five percent is actually attainable, a potential switch from low to high-sulfur oil by utilities might produce savings amounting to about eighteen-million barrels per year. Assuming an average of $1.25 difference between low and high-sulfur oil, an annual fuel cost savings of $22.5 million might be realized. The low-sulfur fuel would be available for use by area sources whise emissions generally have a relatively high impact on ambient air quality.

The price for the fuel savings is paid by the utilities in that they must install and operate the necessary forecasting and monitoring systems to allow implementation of the strategy. About 1000 plants burn coal or oil exclusively. If as many as a half of these installed and operated the necessary intermittent control system monitoring equipment and processing facilities, the total development cost would be about $131 million and the total operating cost would be $51.5 million annually, according to the TVA Experience.[20] The development cost would be recovered within one year by the savings in fuel costs, with an additional potential annual savings amounting to $190 million. The data suggest that these options may offer promising possibilities if they are confirmed by a more detailed study.

Conclusions

This paper has illustrated some types of potential impacts associated with implementation of environmental standards characterized by varying degrees of flexibility. Variable standards should not be interpreted as frequently allowing spurious and arbitrary changes. This would be unacceptable to the general public and would create uncertainty and distrust of the standard-setting and enforcement process by private industry. There are many opportunities to allow for implementation of more flexible standards in order to achieve environmental quality goals on an eco-

nomical basis, particularly for emissions and effluent discharges. These opportunities must be explored and selected through systems analysis of inter-relationships among control technology and environmental, social, and economic impacts. Related issues are forming around apparent conflicts between obtaining an improved environment and abundant energy production and consumption. Both abundant energy and a clean environment are related to the overall quality of life. The question of fixed versus variable standards should be examined in the hope of minimizing or eliminating the apparent conflicts.

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V.5 Emerging level strategies: judicial intervention

Joseph L. Sax *

Environmental problems are not a novelty in American courtrooms. Courts have traditionally abated pollution as a nuisance, and it is quite common for public agencies to obtain judicial enforcement of their orders regulating the use of land, water, and air. In the last few years, however, a new kind of litigation has developed which portends a dramatically different role for the judiciary: The plaintiffs are usually private citizens rather than government agencies; and they sue to enforce rights which they assert as members of the general public, not as property-owners seeking to protect conventional economic interests. Moreover, the governmental agencies which are supposed to be protecting the public interest are often themselves cited as defendants.

Such citizen-initiated litigation is typified by suits against highway departments challenging the necessity or location of a proposed road;[1] actions by local citizens against the United States Forest Service challenging its management of public lands;[2] and suits to enjoin offshore oil-drilling[3] or a proposed airport extension[4] which, it is alleged, will adversely affect scenic or wildlife resources.

In the past, such cases were routinely dismissed at the outset, both because the government was immune from suit and because it was said that private citizens had no "standing" to represent the public interest.[5] The so-called sovereign-immunity doctrine—based largely on the ancient notion that "the king can do no wrong"—has long been discredited as a viable legal theory, and has gradually (though not yet fully) dissipated as an effective defense.

Citizens gain 'standing'

The "standing" doctrine has only recently come under full-scale attack, but it, too, is rapidly losing ground. Courts used to accept unquestioningly the assertion that if citizens were allowed to sue simply as members of the public, the way would be open to a plethora of crank suits. And such suits were thought unnecessary because public officials stood ready to vindicate the public interest. Judicial attitudes toward standing have changed markedly in the last few years. In a recent case, in which local citizens intervened to challenge a radio license renewal by the Federal Communications Commission, the court said:[6]

> The theory that the Commission can always effectively represent the listener interests . . . without the aid and particition of legitimate listener representatives fulfilling the role of private attorneys general is one of those assumptions we collectively try to work with so long as they are reasonably adequate. When it becomes clear . . . that it is no longer a valid assumption which stands up under the realities of actual experience, neither we nor the Commission can continue to rely on it. . . . We cannot fail to note that the long history of complaints . . . had left the Commission virtually unmoved. . . . [T]he renewal application might well have been routinely granted except for the determined and sustained efforts of

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> [the complainng citizens] at no small expense to themselves.

The withdrawal of technical barriers to suit is an important step, but it only sets the stage for the inquiry which courts must undertake once the curtain is drawn back from the process of administrative decision-making. For if it is true that private initiatives are needed to provoke, and at times to displace, administrative agencies charged with protecting the public interest, grave questions are raised about the whole structure of governmental regulation in which we have invested so much of our trust.

Withdrawal of the public trust

If courts were only being asked to correct legal missteps by the agencies in such cases, or to intervene in those rare cases where "arbitrary and capricious action" were said to be involved, the implications would not be so far-reaching. But it is clear that this is not at all the import of most citizen-initiated litigation. Rather, judges are being asked to look behind the exercise of administrative discretion. The charge, bluntly put, is that agencies are not to be trusted to effectuate the public interest; and not simply that they may have misread their statutory mandate in a given case.

It is the agencies' perspective and point of view which is under attack. Judicial uneasiness about this question has become overt in recent decisions. In the radio-licensing case, for example, the court noted that the Commission evinced a "curious neutrality in favor of the licensee," an attitude which put their handling of the matter "beyond repaid" by the usual judicial technique of a remand to the Commission for further proceedings according to proper legal standards. The court took the unusual step of revoking the license itself.

Similarly, in recent Massachusetts cases,[7] in which citizens challenged the highway department's decision to take park land for its own use, the court noted a disturbing insensitivity on the part of the highway agency to the state's concern for the maintenance of public parks. The department claimed it had ample authority under a broad statute which authorized it to "improve" the lands of the commonwealth; thus, it said, it could take park land at will, and its decision to do so must be respected by the judiciary. This was too much for the Supreme Judicial Court of Massachusetts. Plainly annoyed by such arrogance, the court responded:

> The improvement of public lands contemplated by this section does not include the widening of a State highway. It seems rather that the improvement of public lands which the legislature provided for . . . is to preserve such lands so that they may be enjoyed by the people for recreational purposes.

The court held that before the highway department could take park land, it had to go to the legislature and obtain specific authorization.

Judicial disenchantment with the administrative process is by no means new, but contemporary concerns about the environment have cast the problem in a new light; for they have brought home to courts the insufficiency of traditional institutions for dealing with the multiperspective, or ecological, approach which intelligent environmental management implies. Although it was never true that construction of a highway involved only problems of highway engineering, for a long time we seemed satisfied if highway-building agencies acted honestly and according to accepted engineering principles. We asked no more of them, and judicial review of their conduct could thus be limited to the questions whether they were violating statutory standards, or acting arbitrarily.

Narrow standards expand

Those narrow standards no longer suffice. We have come to recognize that a highway project goes beyond the problem of facilitating traffic, and may involve issues of housing, water-pollution, demographic patterns, and a host of other questions. Our perspective has broadened, and a number of statutes now require, for example, that project-building agencies take account of local problems and of all reasonable alternatives to the disruption of parks, wildlife and waterfowl refuges, historic sites, and scenic attractions. Even such prosaic matters as dredge-and-fill permit applications filed with the Corps of Engineers must be referred to state and federal fish and wildlife agencies for consideration of their effects on such resources.

The new breadth of vision is commendable; but there is a wide gap between legislative statements of purpose and fulfillment on the part of deeply entrenched bureaucracies. A traditional single-purpose agency—long committed to getting roads built or rivers dredged—does not become an environmental ombudsman by legislative fiat. An agency staffed principally with highway engineers, long accustomed to dealing with certain limited groups in the communiity, and with a well-established sense of mission and priorities, is not easily transformed. Recent congressional hearings,* for example, revealed that long after the enactment of the Fish and Wildlife Coordination Act, imposing upon the Corps of Engineers responsibility for the aquatic environment, even its formal public notices continued to say:

> The decision of the Department of the Army must be based on the effect the proposed work would have upon navigation, and not on its effect on property values or other considerations having nothing to do with navigation.

Congressional pressure brought about a formal restatement of function, but one need only visit a local Corps office for a brief chat to wonder how much—in outlook, in perspective, and in fact—that agency has modified its traditional stance as a single-minded, navigation-oriented enterprise.

It is this dilemma which has been brought so forcefully to the attention of the courts in the last few years. And judges, who used to say confidently that they ought not to substitute their judgment for the "expertise" of administrators, have begun to ponder whether and to what extent the expertise of the highway department is to be deferred to when the question is highways versus parks.

The problem is not merely that a traditional agency may lack the range of technical expertise needed to evaluate the diverse issues being presented, or that they may have a sense of mission about their function which tends to make them less than disinterested; or even that they have a history of close dealings with certain interests and industries which represent only one of the perspectives to which they are supposed to be attuned. The new ecological perspective to which they have been asked to respond implements a fundamental modification in the nature of the questions before them. To ask an agency to accommodate the demand for roads with the demand for parks and low-cost housing is to thrust upon them far-reaching public policy choices.

Administrative myopia

To make such choices, traditional administrative agencies are peculiarly situated. Their perspective, their narrowness of outlook, their considerable insulation from substantial segments of the public—the very things which make them attractive as a source of technical, managerial decisions—become serious detriments in an agency charged with the resolution of large policy issues. It is this problem which judges in the cases cited above intuitively sensed as they rejected the agency's demands for conventional deferential treatment.

The citizen-initiated lawsuit is thus principally an effort to open the decision-making process to a wider contituency and to force decision-making into a more open and responsive forum. The aid of courts is not sought so that judges will substitute their judgment for that of administrators either on engineering questions or on broad policy issues. Rather, the courts are sought out as an instrumentality whereby complaining citizens can obtain access to a more appropriate form for decision-making.

This phenomenon is more easily described than explained. In the Massachusetts highway-park disputes, the goal was to deprive the highway agency of ultimate authority over the policy question involved and to force the legislature openly to consider and resolve the issue presented by the cases. Technically, the court ruled that the highway department lacked adequate authority to seize park land at will. Essentially, however, the goal of the lawsuit was to put the issue before the legislature, where it would have to be confronted and resolved in the full light of public attention. The court thus ruled in the *Robbins* case:

> It is essential to the expression of plain and explicit authority to divert parklands . . . to new and inconsistent uses that there appear in the legislation not only a statement of the new use but a statement or recital showing in some way legislative awareness of the existing public use. In short, the legislation should express not merely the public will for the new use but its willingness to surrender or forego the existing use.

Expanding democracy

It is with holdings such as this that courts respond to citizen pressures to democratize the decision-making process as it affects issues of environmental quality. The effect of such holdings is suggested by a letter which the plaintiff's attorney wrote, describing the events which followed the court's decision:

> The Legislature of Massachusetts had more discussion over the Fowl Meadow [the parkland involved in the case] than almost anything else . . . in 1969. . . . After a Herculean effort, the House of Representatives in Massachusetts voted 134-90 to authorize a feasibility study of a westerly route, such as we have been working for. However, our local [highway] Department brought out its troops in the form of at least six men who spent most of the week in the State House and, after reconsideration, obtained a bill for an opposite route by the narrow score of 109-105. The Senate concurred after removing some amendments and the Governor signed the bill. However, the whole subject of super-highway construction . . . has been put into the hands of a seven-man commission which is to report whether any new highways are needed. . . . In the meantime, the Governor has stated in public and written us that he will not permit the transfer of the requisite parkland.

To be sure, such litigation does not assure that the advocates of any given position will triumph, or that the legislature will necessarily produce a wise resolution. It does, however, help to move questionable environmental decision-making into a forum where issues of policy must be made and articulated openly, and where legislators must assess the political consequences of taking one position or another. Measured against a system which has been characterized by its responsiveness to particular and limited interest groups, by its single-mindedness and limited perspecetive, and by its penchant for quiet resolution of potential conflict (often revealed in the attitude that the less the public knows, the less trouble there will be), judicial intervention of the type described above is a significant step forward.

Moving the public agencies

In an area such as environmental quality, where we struggle so much to determine what our goals should be, it is instructive to recall, from time to time, the enormous difficulties encountered in getting public agencies to respond to those situations in which there is a substantial consensus about goals; and in which narrow-interest groups have learned to manipulate the governmental process to their own advantage, to the dismay and detriment of the dominant community. All too often the public is simply presented with a *fait accompli*.

It has been traditional to tell complaining citizens to take their problems to the legislature, or to assume that, ultimately, resort to the ballot box will assure effectuation of the public will. The electoral process, as those who have suddenly awakened to see the bulldozers at work well know, is a very blunt instrument. In the swirling multitude of issues that intervene between periodic elections, it is not easy to cast a ballot which clearly says, "I disapprove your highway policy, approve your stance on foreign aid, and abhor your farm policy." Nor is it very realistic to tell a troubled community to go to Congress and get a law enacted to stop a project which is to go forward within a matter of days or weeks.

We have a great deal of rethinking to do about our *laissez faire* attitudes and assumptions about the *process* of government. Among the very significant matters being raised by environmental litigation is whether, and to what extent, institutions like the judiciary can, and should, intervene to help make that process work more effectively. The technique described above—essentially a judicial remand to the legislature—is one device that is now being tested. In essence, it says, "Yes, the citizens should go to the legislature, but a court order may be needed to assure that they can get there in time, and under circumstances which help to assure that their voices will be heard." It may seem ironic that courts are needed to help make the legislative process work effectively; that citizens must come to the least democratic of the branches of government to make democracy work. But that is one of the intriguing questions now being explored under the label of environmental litigation.

Notes for Paper 5

[1] Citizens' Committee for the Hudson Valley v. Volpe, 302 F. Supp. 1083 (S.D. N.Y. 1969); Road Review League v. Boyd, 270 F. Supp. 650 (S.D.N.Y. 1967).

[2] Parker v. United States, Civil No. C-1368 (D. Colo., filed Jan. 7, 1969); Sierra Club v. Hickel et al., Civil No. 51,464 (N.D. Cal., filed June 5, 1969).

[3] Weigand v. Hickel, No. 69-1317-EC (S.D. Cal., filed July 10, 1969).

[4] Abbot v. Osborn, No. 1465 (Super. Ct., Dukes County, Mass., filed March, 1969).

[5] National Parks Ass'n. v. Udall, Civil No. 3904-62 (D.D.C. 1962).

[6] Office of Communication, United Church of Christ v. Federal Communications Comm'n., 359 F.2d 994 (D.C. Cir. 1966).

[7] Sacco v. Department of Public Works, 352 Mass. 670,227 N.E. 2nd 478 (1967); Robbins v. Department of Public Works, 214 N.E. 2d 577 (1969).

[8] Estuarine Areas, Hearings Before a Subcommittee on Fisheries and Wildlife Conservation, Committee on Merchant Marine and Fisheries, House of Representatives, 90th Cong., 1st Sess., Serial No. 90-3 (1967).

V.6 Enforcing environmental law in the city

Norman Redlich *

Several broad concepts are important in organizing municipal government to play its role in environmental control. First, government at the municipal level must organize and structure itself environmentally. Prior to Mayor John Lindsay's administration in January, 1966, in New York City the traditional municipal departments handled environmental programs: the Sanitation Department, the Department of Air Pollution Control, the Department of Water Resources, etc. These separate departments were not unified in an environmental context. Since that time, these entities have been combined into one so-called "super-agency," the Environmental Protection Administration, which has the capacity to plan, select priorities, and to budget in environmental terms. For example, if an air pollution control measure would prevent burning garbage in incinerators, the impact of that action on solid waste collection and disposal should also be considered before the decision is made. In a single agency, such coordination is facilitated.

Interdepartmental decisions

Local governments as well as state governments have to organize to make the hard priority choices, for example, the selection of power plants. In New York, we have created an interdepartmental committee on public utilities. We recognize that to deal with such questions as ratemaking, we must first decide whether we want to curb the use of electric air conditioners and electric heating and where we plan to locate a particular plant. To make these decisions we needed a combined intergovernmental roof consisting of our city planners, our Consumer Affairs Commissioner, our Environmental Protection Administrator, and the Administrator of Municipal Services (who is responsible for providing power for the city). It is important that local governments create a structure which can deal with the complexities of the environmental conflict.

There are two aspects of the legal framework that appear obvious, but are often overlooked—the method by which we identify and regulate pollution problems, and the enforcement mechanism. Traditionally, local governments controlled the environment through a haphazard and nonscientific approach—chasing smoke, trying to keep people from making loud noises, etc. Enforcement consisted of issuing summonses to people who were making loud noises, or who were causing dark smoke to come out of chimneys. People often ignore these summonses. It is an improper use of valuable police resources for the police to spend time following up these violations.

Nuisance abatement

Another traditional method of law enforcement is the abatement of nuisances. When somebody complained enough, the city's lawyers went to court in order to "abate a nuisance." This is basically an injunctive remedy which is totally ill-suited to the urban environment. There simply are not enough policemen to issue summonses, nor enough city lawyers to handle injunctions, nor enough courts who are willing to spend their resources in concontempt citations. The urban scene is different from a rural scene, where the injunctive remedy against a major polluting factory has some significance. The urban scene requires different tech-

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niques, some of which we have tried in our city.

The basic technique is to deal with the cause of pollution by imposing standards on the actual device which is the polluting instrument. Such devices include incinerators, noise generators, and fuel-burning equipment. Another enforcement technique is requiring permits to operate certain types of devices —this enables the enforcing agency to set certain standards in order to obtain such a permit. We also set standards for fuels. The permissible sulfur content in our fuels is a standard which has been set by local law in our city. Compliance need not be measured by the old cumbersome method of determining whether there was too much sulfur dioxide or particulate matter in the air. The New York City Air Pollution Code and the Noise Pollution Code are scientific documents setting certain very precise standards with regard to the amount of contaminants in the air, the amount of sulfur in our fuel, and the decibel level of various types of noise devices.

Moreover, the Administrator has the power and authority to test various devices to determine whether they are meeting these standards. Setting very precise standards is a two-fold weapon. First, they enable a fairly scientific method of testing, so that even without a complaint we can test a particular device to see whether it is exceeding a decibel level or whether it is exceeding a given air pollution level. Second, by setting specific measurable standards, violators can be prosecuted. Through the use of standards-setting and permit requirements, a range of enforcement techniques become available. It becomes possible to prosecute someone for failing to renew an operating permit or an operating certificate. A cease and desist order can be issued to prevent a person from operating without a given type of approved certificate. An order can be issued compelling various types of improvements in the particular polluting device in order to eliminate the offending characteristics.

An environmental tribunal

It is terribly important to remove these cases, as much as possible, from the courts and into an administrative agency. The City of New York has created an environmental control board which acts as an administrative tribunal, consisting of five city officials and four qualified persons from outside the government. Their job is to enforce the aforementioned environmental provisions. It has the power to issue cease and desist orders; it has the power to revoke permits and operating certificates; and it has the power to impose civil penalties which can be as much as $100 per day for every day of violation. These civil penalties can be enforced in court. Thus far, under our law they must be reduced to a judgment. We are hoping to secure state legislation which would enable us to enforce these penalties without the necessity of reducing them to judgment, subject only to judicial review (under the doctrine of preventing arbitrary, illegal and capricious penalties). One of the great unsettled questions in this area is the extent to which the courts will respect the decisions of an administrative tribunal. If they do not give weight to the decisions of the administrative tribunal, the proceedings will be repeated in the courts and the entire administrative process will have been largely a waste of time. On this the returns are not yet in.

Finally, we have adopted a citizen complaint technique, which is particularly useful at the local level. A citizen can file a complaint with the environmental control board alleging a violation of the various standards set forth in our code. It is the option of the administrative agency to prosecute that complaint. If it decides not to, the citizen can prosecute it himself in his own course. If there is a fine imposed, there is a sliding bounty system, whereby the citizen will get a percentage of whatever is recovered, and will get a higher percentage if it turns out that he was right and the government agency was wrong in refusing to prosecute the citizen's case. This system has evoked widespread crticism that we are creating a city of bounty-seeking informers, but we think it is possibly a very useful enforcement method.

The use of these major legal weapons and institutions by local governments can enable them effectively to play their role in controlling the environment.

V.7 Strategies for environmental management

Allen V. Kneese *

Perhaps the most encouraging aspect of the present situation regarding natural resources and environment is the deep and widespread public concern about it. To a large extent, we owe this concern and even alarm to the ecologists. As an economist, I am interested to see that there is now a market developing for forecasts of disaster, and some competition is growing up among the practitioners of this art to see who can come up with the most ingeniously worked-out vision of the apocalypse.

An interesting example of inconsistent and even countervailing visions is with respect to the weather. We have been told that the discharge of CO_2 and heat to the atmosphere will cause the polar ice caps to melt and drown our cities. Now it turns out that in recent years the earth's temperature has been falling. Aha!—we are told—that is because the discharge of particulates into the atmosphere from human activities is reflecting the sun's rays. No, says another expert, not at all; volcanic action has been strong in recent years and by comparison the discharge of particulates from human activities is minimal.

Ignorance of man's impact

I present this example not to try to generate confidence that our environmental problems are not so bad after all, but to point out that we know very little for sure about the impact of modern man's activities on the geophysical world, not to mention the biological world. In a way I would feel more comfortable if we knew for certain that we would raise the world's temperature by a degree or two over the next century, rather than to be so aware of the depths of uncertainty in which we operate. The same is clearly true, and could easily be documented, with respect to a host of more limited impacts than the global weather one just discussed.

Clearly, then, one highly important task before us is to strengthen and consolidate our geophysical and biological research efforts so that we can better understand these systems and the impacts on them of various events.

But of equal importance, and much neglected in the recent and often rather frantic discussions of the environment, is understanding why the social and economic systems produce the results they do and how we can use understanding of them to produce more desirable ones—call it social engineering, if you will. Illustrations of the poverty of understanding in this area are the frequent calls for morality with respect to the environment (morality is clearly needed, but the problem is not primarily a matter of failing morals), wondering why the problem does not go away when federal subsidies are provided (federal subsidies may be needed to help catch up, but they do not do anything positive to change perverse incentive structures), and a search for technological fixes (technology can help as well as hurt, but it cannot, alas, relieve us of our task to design an economic and political system which produces desirable results).

Common and private property

It has often been said that what we need is a new morality or a new ethic if we are to avoid despoiling the earth. This is really a call for a new set of values which lays more emphasis on the natural, the tranquil, the beautiful, and the very long run. These are values very appealing to me, but holding them

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really says nothing about the social mechanisms through which they might be realized to a higher degree. Even "good" people need rules to live by, especially where the impact of a single person's behavior on the total problem is extremely small. Moreover, it has long been realized that a system which does not rely heavily on the fulfillment of the self-interest of the individual or the family must soon become undemocratic or unworkable.

A definition of environment or environmental quality which would suit everyone seems to be impossible. But I think that most social scientists have something like the economist's concept of "common property resources" in mind when they speak of the environment. The concept of a common property resource (which should not be confused with a similar legal terminology) encompasses those valuable attributes of the natural world which cannot be, or can be only imperfectly, reduced to individual ownership and therefore do not enter into the processes of market exchange and the price system. It should be noted that this concept is inherently a social rather than a natural science one, but that the resources to which it relates are normally attributes of the natural world rather than the direct services of human beings. Notable among such resources are the air mantle, watercourses, complex ecological systems, and at least certain attributes of space. The last include the visual properties of landscape and the radio spectrum, among others.

The main feature which all these common property (or, in our context, environmental) resources have in common is that they are subject to congestion. At some low level of use, an additional user of the resource may impose virtually no cost on others. A point is reached, however, where an additional user will cause others to have to incur additional costs or suffer disutilities associated with congestion. When this stage is reached, what economists call an externality or spill-over effect occurs. In other words, a particular user does not take account of the cost he imposes on others when he decides to use the common property resource. Many instances of this surround us—environmental pollution, mutual interference of radio signals, congestion on public roadways and in public recreation areas, jet plane noise, and scarred landscapes, among many others

Limits to the market system

Our usual mechanism for limiting the use of resources and leading them into their highest productivity employments is the prices which are established in markets through exchanges between buyers and sellers. For common property resources this mechanism does not function, and they must become the focus for collective action on public management, unless they are to be severely overused and misused. This idea has been well developed in the economics literature with respect to particular resources like ocean fisheries. How pervasive common property problems have become has not been widely appreciated by economists, at least not until recently.[3]

Water quality management

Let us turn to an area where I believe that research has already laid a reasonably satisfactory groundwork for implementing the type of strategy outlined above. This is the area of water pollution control. In my opinion our present strategy in this area does not have an orientation which will lead toward effective, efficient, and continuing management of the problem.[4]

What I take to be the present strategy of the federal government for achieving water pollution control in the United States is based on two main elements. The first is financial support for the construction of municipal waste treatment plants. Such support started with the Federal Water Pollution Control Act of 1956 and has continued at higher levels of authorization since then. The 1966 Act authorized $3.4 billion for municipal sewage plant construction grants over the period 1968-71. Under the Act it is possible for municipalities to cover up to 55 percent of the construction costs of waste treatment plants from federal grants.

The second element in our pollution control strategy was instituted by the Water Pollution Control Act of 1965, which required that all states set water quality standards on their interstate and boundary waters. These standards were to be completed and reviewed by the Secretary of the Interior by mid-1967. Understandably enough, there were some delays, but the required standards are now for the most part in existence. The standards were to be accompanied by a proposed program for achieving them, which could then be used as a benchmark against which to judge the need for federal enforcement actions. Actually, while the federal government has had authority to bring enforcement proceedings against interstate polluters in the past, this power has been used only to a very limited extent.

Limited success

Without in any way denigrating the great and sustained efforts made by Senator Muskie and others to provide us with effective pollution control legislation, I think it is fair to say that the results of our pollution control strategy up to this point have been disappointing to many. The construction of municipal treatment plants has been lagging partly because federal appropriations have fallen far behind authorizations (the authorization for 1970 is $1-billion and Congress has appropriated $800-million), and many people assert that municipalities are holding up construction until federal funds become available. It is hard to say why federal enforcement powers have not been more effective, but possibly it is because of the difficulty and cost of mounting effective enforcement proceedings, as well as the political power of the larger industries. Our record of trying to impose direct federal regulations on large industries has been dismal.[3]

Another government report by the General Accounting Office has provided a rather devastating critique of the present strategy, based primarily on the scatter-shot way in which support has been provided to municipal treatment plants, the poor operation of existing plants, and the overwhelming growth of industrial discharges.[4] In every major river system studied by the GAO, the conclusion was the same: We have failed to mount a significant attack against the major contributors to pollution. Relying exclusively on the tool of enforcement to remedy this situation would, I am sure, be awkward, unpleasant, expensive, and effective at best only in a static and short-run sense.

The industry problem

As part of our subsidy-enforcement strategy, many bills have been introduced in Congress to provide federal subsidies for the construction of industrial waste treatment plants. These proposals have for the most part so far not been successful. From the point of view of trying to achieve an efficient as well as an effective pollution control policy, this may be regarded as fortunate. For reasons that I will discuss further later, subsidies for industrial waste treatment would tend to be less efficient than incentives to adopt other waste reduction procedures, such as recycling and by-product recovery. Moreover, they would have the unfortunate effect of diminishing the extent to which costs of using the common property resource are reflected in the goods which consumers buy, thus leading to too much consumption of them relative to their social cost of production. In addition to considerations of efficiency, many people also regard it as just or equitable that those industries and consumers who use common property resources to the detriment of others bear the cost of doing so.

Unfortunately, a certain amount of subsidy has already crept into the system. Some industrial plants are connected to municipal systems and can benefit from the subsidies to municipal treatment plant construction. Furthermore, the tax reform bill recently passed by Congress would provide for five-year tax amortization of pollution control facilities and would, according to the testimony of Stanley Surrey before the Joint Economic Committee, cost the government $400 million a year in foregone revenue.[5] In addition to the points already made about the inefficiencies of subsidies, a weakness of rapid tax amortization is that it cannot help those marginal firms which often serve as the excuse for subsidy arrangements. Tax writeoffs would seem to be a particularly perverse way to try to deal wtih the situation. They have the effect of providing most assistance where it is not particularly needed and, unless counteracted by other provisions, letting die the industrial plant where assistance might be justified. Subsidies, of course, do have the politically attractive features of spreading burdens so widely that no individual has an incentive to compain very loudly. If they can be hidden behind the complexities of the tax system it is even better. When Charles Schultze was Director of the Bureau of the Budget, he had a sign hanging in his office which said, "If you can't solve the problem, subsidize it." There is an unfortunate amount of truth in this slogan.

Several years ago, I proposed an alternative strategy for dealing with our national water pollution problems.[6] This proposed strategy was also based on two main elements. The first rests on the concept that the waste discharger should insofar as possible bear the damages his waste disposal activities impose on the common property resources of society, and the second recognizes that in many of our highly developed basins, where pollution problems are concentrated, great savings in costs can be obtained by the implementation of a systematic and well-integrated plan for water quality management on a regional basis. The latter would contain elements other than just the treatment of waste waters at particular outfalls.

Pollution as bad business

With respect to the first element, I think we must devise ways of reflecting the costs of using resources that are the common property of everyone, like our watercourses, directly in the decision-making of industries, local government, and consumers. The capacity of our rivers for assimilating waste is a valuable asset, and these rivers have alternative uses which conflict directly with waste disposal. Because our property institutions cannot adequately be applied to resources like watercourses, they are essentially unpriced and treated as free goods, even though they are in fact resources of great and increasing value in the contemporary world. This unhappy situation cannot be remedied unless we move toward the implementation of publicly administered prices for waste discharge to watercourses and for the use of other common property resources.

Effluent charges

Accordingly, one element for water quality management is a system of what I have termed "effluent charges." The proceeds from such charges would yield a rent on a scarce resource to society which would be used in various ways, including further measures to improve water quality, as discussed below. Also, and even more importantly, the effluent charge would provide an incentive toward conservation in the use of the watercourses for waste discharge. Careful industry studies have shown that industries can often reduce waste discharges enormously, usually at low cost, if they are given a proper incentive to do so.[7] In many instances, the most effective means for reducing waste discharges are changes in internal processes and recovery and recycling of materials that would otherwise be lost.

Similarly, under our present property institutions, municipalities are paying only part of the social costs of disposing waste to streams, and what they pay is rather capriciously distributed, depending on how much waste treatment they have implemented. A system of effluent charges would give these municipalities an incentive to proceed expeditiously in the treatment of waste. Another point of some importance is that our present policies put heavy emphasis on the construction of plants with little or no follow-through on operations. Experts have pointed out that most treatment plants are operated far below their capabilities. Effluent charges focus on what is put in the stream and thereby offer an incentive for the effective operation of existing facilities. A number of persons have seen fit to dub the effluent charge "a license to pollute," in the hope, no doubt, that this cliche, because of its emotive power, would be regarded as conclusive argument. This mindless cliche has certainly not contributed to the cause of effective water quality management. It is also sometimes said that effluent charges cannot be implemented because industries do not know what they discharge to watercourses. The latter part of this statement is, unfortunately, frequently true. But is it not high time to remedy the situation?

It should be clearly recognized that the present and proposed subsidy arrangements are quite different and, most economists would feel, less desirable in their impacts than effluent charges.

First, the system of effluent charges is based on the concept that efficiency and equity require payment for the use of valuable resources whether they happen to be privately or collectively owned. These prices will be reflected in the industrial producers' decision to install treatment equipment and otherwise reduce the generations of residuals. They will also be reflected in the price of intermediate and final goods, so that a broader incentive will be provided to shift to goods with a lesser environmental cost.

Second, subsidies for the construction of treatment plants do not, by themselves, provide an incentive to take action to control waste discharges. Even if an industry is paid a major proportion of the construction cost of a waste treatment plant, it is still cheaper, from the point of view of the industry, to dump untreated waste into the river. Thus the subsidy arrangement cannot work unless accompanied by enforcement or other pressures on the waste discharger.

Third, to the extent that the subsidy system works it tends to bias the choice of techniques in an inefficient direction. It would provide an incentive to construct treatment plants with federal subsidies even where internal controls would be cheaper.

Finally, the system of effluent charges yields revenue, rather than further straining and eroding an already seriously over-extended tax system. This revenue can be put to useful public purposes, including improvements in the quality of our environment. From an economic point of view perhaps the best imaginable tax base is an activity that causes external diseconomies. Not only does a tax on such a base yield revenue, but it tends to improve the over-all allocation of resources.

Implementing effluent charges

Most economists who have studied the matter concluded that there are compelling reasons for favoring effluent charges as one of the cornerstones of effective and efficient regional water quality management. But it may be difficult for particular states and regions to pioneer such a substantial departure from previous practice. The federal government's greater insulation from powerful local interests provides an opportunity for leadership. One approach would be for the federal government to levy a national effluent charge on all waste dischargers above some minimum amount. The charge could be based on a formula similar to those that are used in the Ruhr area of West Germany or one of those used by certain U.S. municipalities in levying sewer service charges upon industry. This charge could be considered a minimum which could at discretion be exceeded by a state or regional agency having responsibility for water quality. Revenues obtained by the federal government could be made available for purposes of financing the federal program, with the excess turned over to other governments of general jurisdiction, or, and I think preferably, the revenues could be used to establish regional agencies for the management of water quality, which are the other element in my proposed strategy.

Regional view of water quality

Research on the management of water quality over the past several years has clearly shown that major efficiencies can be obtained by the implementation of systems on a regional basis. In addition to the standard treatment of waste waters, such management systems could include a number of other alternatives closely articulated in planning and operation. These could include riverflow regulation, putting air directly into streams, brief periods of high-level chemical treatment during adverse conditions, and others. Studies of the Potomac, the Miami of Ohio, the Delaware, the San Francisco Bay region, and of other areas have shown beyond question the economies to be realized by this kind of regional approach. It appears that such an approach can only be effectively implemented by a regional river basin agency having the authority to plan, construct, and operate the necessary facilities. Again, there is a role for federal leadership in the establishment of such agencies. So far, tendencies to support such an approach at the federal level have been minimal.

An environmental TVA

The federal government could, of course, take direct action. It could set up regional agencies for the management of water quality or water resources. These could be separate entities, like TVA, or regional units of federal agencies, as proposed by the first Hoover Commission. There has been so much opposition to arrangements of this nature that it is questionable whether the federal government should or would be willing to move in this fashion. An alternative would be for the federal government to establish incentives and guidelines for the organization and operation of regional management agencies, either under state law or through interstate compacts. An agency with adequate authority to plan and implement a regional management system would be eligible for a grant of funds to support a portion of its budget—to help staff the agency and to make the first data collections, analyses, and formulation of specific measures for water quality management. If the federal government were satisfied that the proposed program and the plan for its implementation satisfied criteria for its efficient operation, the agency might be eligible for a grant to assist it with actual construction and operating expenses. Such a system might appropriately be limited to the early implementation—say, five years. During this period, it would be necessary to work out longer-term arrangements for financing the agency. Clearly, the proposed system of effluent charges could play a major role. Presumably, administration of the effluent charges would be turned over to the regional agencies, with the federal level of charges continuing to be regarded as a baseline. In this manner, regional scale measures would be financed while at the same time providing appropriate incentives to waste dischargers to cut back on their emissions. The federal law might include special provisions for marginal industrial plants which might otherwise go under and where this protection is in the broader social interest. It should be noted that where serious efforts to implement regional management of water quality have been undertaken (as in the Delaware and the Miami river basins), one of the most serious problems has been in setting up adequate financing arrangements.

I have no doubt that federal leadership toward implementation of a system of effluent charges and the creation of regional management agencies can put us on the path to continuing, effective, and efficient management of the quality of our waters. I believe that this approach merits serious considerations as a strategy for dealing with our serious national water pollution problem.

Notes for Paper 7

[1] In this connection, see Allen V. Kneese and Ralph C. d'Arge, "Persuasive External Costs and the Response of Society," in The Analysis and Evaluation of Public Expenditures: The PPB System, a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee (91st Congress, 1st Session, 1969).

[2] Most of the points in this section are discussed in more detail in Allen V. Kneese and Blair T. Bower, Managing Water Quality: Economics, Technology, Institutions (Baltimore: Johns Hopkins Press, 1968).

[3] For a recent discussion of this point, see "Economic Analysis and the Efficiency of Government," Report on Economy in Government of the Joint Committee (Joint Committee Print, 91st Congress, 2nd Session, February 9, 1970), p. 35.

[4] See "Examination Into the Effectiveness of the Construction Grant Program for Abating, Controlling and Preventing Water Pollution" (Report to the Congress by the Comptroller General of the United States, November 3, 1969).

[5] "Economic Analysis and the Efficiency of Government," op. cit., p. 91.

[6] Allen V. Kneese, The Economics of Regional Water Quality Management (Baltimore: Johns Hopkins Press, 1964).

[7] See, for example, George O. G. Lof and Allen V. Kneese, The Economics of Water Utilization in the Beet Sugar Industry (Baltimore: Johns Hopkins Press, 1968).

VI: Environmental Management Information Systems

Because of the complexity of environmental relationships and the subtlety of their changes over time, most environmental decisions are made on the basis of political proclivities and expediency rather than on a detailed analysis of the relevant data. Assuring that the needed information is available at the proper place and time to influence environmental decisions is a difficult responsibility. In the past, this task has generally been left up to private interest groups—each group encouraging its own perceived aspect of the situation. Such a fragmented approach to information gathering is gradually being challenged by more formal, more disciplined methods. The papers contained in this chapter address different aspects of this environmental information/decision-making construct.

Some basic considerations that go into the design of an Environmental Management Information System (EMIS) are aired by Stanley Wolfson, Director of the Urban Data Services of ICMA. After defining the socio-economic objectives and desired output of an EMIS system, the next step is to explicitly determine the precise topical areas to be covered and their concommitant data requirements. "The goal in the data collection process is to create standard definitions, identifications and classifications of data so that the manager receives timely reliable data that is useful for intra-regional comparisons," Wolfson notes.

Wolfson sees the computer as playing a key role in recording, storing and processing data into useful information. He discusses the various types of models and simulations that can be developed and differentiates among them. The end goal of all these efforts is, of course, to provide managers more planning time, relieve their burden of research, help evaluate alternative policies and anticipate environmentally induced changes.

CHANNEL ONE: NEW YORK'S ENVIRONMENTAL TV

One unique effort at improving the communication of environmental information is described by Rodman T. Davis, Director of Planning with the Metropolitan Regional Council of New York City. In the tri-state New York metropolitan area, the local Metropolitan Regional Council has inaugurated a small closed-circuit television network. Via this network, environmental administrators, mayors, department heads, etc. will be able to establish an instant conference on environmental issues. An initial demonstration project will connect ten major counties and cities.

Davis explains the motivations behind the system:

> "Local governments are bombarded with all kinds of either contradictory or non-conclusive information related to environmental management . . . We have incredible amounts of information in our administrative system, but it is not presently comprehensive, cohesive or communicated so that systematic decisions may be made. The New York region has begun to address this problem by utilizing innovative communication technology."

Another approach to improving the communication of environment-related information is being implemented by the Oklahoma Environmental Information and Media Center. Dr. Robert V. Garner, Director of the Center, notes that "a state-wide environmental action plan indicated that one of the most pressing environmental needs concerned environmental information and data." After gathering information in various formats (books, microfiche, films, slides, etc.) from several sources, the Center began conducting problem-oriented searches, field services, public education displays, publication of fact sheets and news releases. At some future date, the information retrieval system may be automated.

To attempt to systhesize existing data into a measurement system for analyzing environmental quality, the Arizona Trade-Off Model (ATOM) employs complex modeling techniques. The model uses 66 measurable variables (river sediment load, game animals, ecosystem productivity rate, air pollution particulate matter, etc.) to construct a weighted numeric output. This output can then be used in the analysis of various public policy trade-off solutions.

EFFECTIVE MANAGEMENT THREATENED BY COMPLEXITY

> "When environmental and ecological sensitivities and responsibilities of the (modern governmental and industrial management) organization must be considered, the complexity of management and of the information needed to support management is increased well beyond the capabilities of present management procedures and their associated automated information systems."

This is how the Gulf Universities Research Consortium defines the problem addressed by their EDMPAS (Environment-Dependent Management Process Automation and Simulation) system. Since August of 1971 the multi-university team has simulated many of the functions in the management information feedback loop process. The preliminary analysis of their progress to date is presented in paper VI.5.

Another sophisticated modeling project—the Integrated Regional Environmental Management (IREM) project—is being conducted by the San Diego County Comprehensive Planning Organization. Designed to aid in developing and implementing a comprehensive regional plan, the IREM project utilizes planning models to evaluate alternative policies for land use and transportation patterns.

For policy analysis, the IREM system can be used to test: regional growth policies, alternative development policies, alternative transportation systems, air quality standards and regional goals and evaluation criteria. Among the model's outputs will be regional population and employment forecasts, alternative regional development patterns and future travel patterns by mode. Forecasts are made for five-year intervals. Despite its rather gross assumptions and data requirements, the model does integrate environmental considerations into the policy-making process, is flexible enough to meet the region's needs and is technically viable.

On a more generalized basis, the General Environmental Model (GEM) is a developing urban policy model. GEM will be useful in the year-to-year projection of urban developments under differing governmental, social and economic policy assumptions. Using specific policy criteria as input, GEM will produce spatial and temporal distributions. Indicies are produced for air and water pollution, housing quality and costs, quality of public services and public preferences for goods and services. When completed, GEM will consist of various subsections to meet the needs of a variety of users. One of the more advanced attributes that GEM will have is the ability to simulate the differing environmental relationships in several types of urban areas.

EAS: EPA'S LONG-RANGE FORECASTING SYSTEM

Finally, this chapter ends with a discussion of the Strategic Environmental Assessment System (SEAS) by EPA Assistant Administrator for Research and Development Dr. Stanley M. Greenfield. SEAS is an advanced research project designed to help provide the means to forecast long-range effects of societal actions so as to avoid deleterious environmental impacts. Through a combination of proven computerized models, accurate data and expert analysis, the SEAS system will be able to forecast, a decade or more ahead, potential environmental problems and opportunities.

Dealing explicitly with pollution generators, possible controls and known residuals effects, SEAS will be a national-level model system for use by EPA headquarters and regional policy-makers. SEAS will be a complex model system, attempting to tie together the interrelated areas of environmental and socio-economic trends.

VI.1 Design for an environmental management information system

Stanley Wolfson *

As the complexity of environmental problems increases, the decision maker's need for comprehensive information increases. In most regions, the environmental manager must understand the technical and legal issues related to industrial pollution, resource management, interpretation of pollution levels, transportation systems, and population growth. The development of effective programs and policies of environmental management requires an adequate means of obtaining, processing, and applying information or data to these types of problems.

In designing an environmental management information system (EMIS), managers are increasingly turning to computer technology and quantitative analysis. The first step in devising an EMIS is to define the economic and social objectives or desired output of the system.

Clarify your goals

The data collating and processing phases are based on the manager's determination of the type of information system required. Setting a broad goal such as "improving the region's environment" will complicate the task of implementing an EMIS. While such a broad goal may be a long-term decision, the manager must define goals and objectives more specificaly. The manager must determine what information is needed to guide and strengthen his decisions. Information needs, for example, should be expressed as examining pollutant levels or air quality standards; evaluating the transportation system in relation to its pollutants, capacity, and future needs; or examining land use for the region.

Managers must be cognizant of those parameters that will be included in order to achieve an adequate final system design. The final determination for the system's operation should be made by the manager rather than research and computer analysts.

Specific objectives of the information system should be carefully conceived and explicitly stated. What types of pollutants should be considered? What types of land uses should be examined: recreational, residential, industrial? What alternatives to tarnsportation systems should be examined: buses, rapid transit, banning automobiles, gas rationing? What economic characteristics should be examined: population, income, employment, prices, production? The objectives should be carefully detailed without, at this stage, detailing how results should be achieved.

Determine the system's limits

Subsequent to detailing specific objectives, it is necessary to establish the constraints that ought to be built into the system. Constraints are limitations placed on the achievement of an objective. For example, cost, time, and personal constraints may be placed on achieving the overall objective of an EMIS. Limitations will probably have to be established for the variables in relation to those controllable by management and those that are not. Noncontrolled variables involve levels of detail and resource assignment too costly and time consuming for most information systems.

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*Stanley Wolfson is the director of the Urban Data Service Center, ICMA.

What appears to be a good pollution information system at a reasonable cost may turn out to be inadequate when new viewpoints and alternatives are examined, especialy for the variables included and overall system design. An additional expenditure of five percent for better data collection may be all that is needed to transform a fair system into an excellent system.

Definite criteria should be established for evaluating each alternative. These criteria may involve simply a written report indicating pros and cons of each alternative to a specific analytical process for evaluation. Each alternative should be evaluated in relation to the original objectives and constraints. The manager must keep an open mind to alternatives and be ready to modify unrealistic objectives, goals, constraints or the alternatives, if a viable system is to be established.

Keep variables relevant

The manager must define the specific economic, demographic, and environmental variables relevant for policymaking, based on present knowledge and problems and future expectations. A variable is an element (pollution, land use) or attribute (amount, size, age) which is under empirical investigation. Variables may be qualitative or quantitative, and the concern of the environmental manager is to understand the relationship among variables in order to assist in the evaluation of competing policy alternatives.

The next phase involves determining whether the necessary data is available and can be maintained and collected on a continuing basis, at a reasonable cost, and with an acceptable level of statistical validity and reliability. For example, in order to evaluate economic growth, data must be available on population, income, employment, housing. Comprehensive analysis may be limited if the data is not collected on a continuing basis or if there are distortions in the data due to variations in methods of collection.

The goal in the data-collection process is to create standard definitions, identifications, and classifications of data so that the managers receive timely, reliable data that is useful for inter- and intra-regional comparisons. Ultimately, the information system, more than a simple inventory of data processes, must transform data into useable information for purposes of decision making. An unrealistic database design is the major reason for an information system's failure (i.e. one that is overly detailed, or fragmented). The failure is a result of poor design, unused and unuseable data, and excessive cost burdens to maintain current data. Data elements common to more than one component of the system should be identified and evaluated with a view towards multiple purposes (i.e. an integrated database).

A necessary tool for recording, storing, and processing data is the computer. It combines speed with accuracy and economy; it can sort, store, calculate, merge, correlate, and otherwise manipulate data at high speeds. They rarely make mistakes and reduce data collection and processing costs. Most mistakes that do occur are caused by humans; the computer performs only those functions programmed for them. Three important characteristics explain the extraordinary utility of computers: storage capacity—which permits the adaptation of a central or common data file and allows for the inclusion of all data input for each process; direct interrogation of the system via remote inquiry devices; and legibility of computer output—which may take the form of tabular listings, mappings, graphical display, and printed text.

Computers require good people

An accurate, worthwhile computer-based EMIS cannot be built overnight. The manager should ascertain, with expert assistance, the computer hardware and software (e.g. computer programming) needed for the application of a system. Many presently operating regional systems may be modified, expanded or combined, thereby reducing the time needed to establish a working data base and EMIS. However, the capabilities of any computer system are limited by the ability and techniques of the computer analyst or programmer. It is the analysts who conceptualize a problem and make decisions about how a problem will be solved. Analysts integrate data with statistical and overall design and guidance of the system. In thinking about alterantive designs for a total EMIS, the manager should consider in-house capabilities, as well as assistance from universities and consulting firms.

A properly instituted EMIS will give managers more planning time without the need for extensive research, provide for the evaluation of alternative actions, and anticipate environmentally induced changes that will effectively centralize the control of the information and analysis process.

Implementation of an EMIS requires a close working relationship between managers and research and computer analysts. Analysts translate technical methods and concepts into a practical language to meet the needs of the manager. However, the manager must have sufficient knowledge of the disciplines available for analysts, have a rudimentary understanding of their techniques and language, and be able to grasp the importance of quantitative analysis.

Models and simulation

In order to respond to a request for information on an environmental problem from the manager, the research and computer analyst's first step is to develop a model or simulation.

Models present an abstraction of reality. A model simplifies reality by using a small number of variables to describe, explain and predict a phenomenon (e.g. using population increases to predict additional employment).

There are three basic types of models: iconic or physical; analogue or abstract; and symbolic. The iconic or physical models look like what they represent, that is, a "model" airplane or ship, or maps and drawings. The analogue or abstract model uses symbols to represent a set of properties of reality. For example, using words to describe reality, for an object or lines on a photograph to represent contours. The symbolic model uses symbols (letters, numbers) to represent a relationship of reality. This type of model is usually specified by a mathematical relationship.

Models are simplifications of reality that supply alternatives for solving a problem. While it is possible to make extremely complex models, they are usually incapable of being used directly for decision purposes without additional analysis.

Models may be simplified in four ways. The first way is by omitting some variables. Only those variables offering a specified level of significance should be maintained in a model. For example, transportation variables that may be included are buses, cars and trucks. However, detailing makes and models of each would add little additional significance to the outcome. Variables may also be aggregated to reduce their number. Income groups may be classified as high, middle, and low rather than broken down into more refined categories.

Second, the manner in which variables are used may be changed. Rather than using explicit distributions of a variable, an average value may be used so that the variable may be considered a constant, for example, the average number of new housing starts per month.

Third, relationships between variables may be changed. The most common type of relationship change is substituting a linear relationship for a nonlinear one. For example, pollution may increase at an increasing rate as automobile weight increases, until some limiting weight is reached whereby pollutants increase at a decreasing rate no matter how much more an automobile weighs (an exponential function). This type of situation may be simplified with a straight linear relationship explaining that pollutants increase as automobile weight increases.

The fourth possibility is to modify the constraints of the model. Constraints can be added, subtracted, or changed to simplify a model. Requiring industry to add pollution abatement may cause a shortage of production to occur to some maiximum limit. The model would obviously need an estimate of these shortages, although such an estimate would probably be extremely difficult to obtain. However, as the shortage increases, the costs and difficulty in reducing polution may become higher. A constraint may then be built in so that lost production does not exceed this upper amount.

Two levels of models

Environmental models are time-consuming to construct and extremely complex. It is therefore necessary to construct a model in parts so that the final result is a multiple model (or a large model with many sub-models). The output of one model may become the input to other models. Determining air quality standards would require, at a minimum, the input from an economic characteristics model to determine population and industrial growth. Input would also be required from a transportation model to determine traffic congestion and patterns, which in turn requires input from the economic growth model. Multiple models may function completely independently, with each model providing a set of solutions, or sequentially, with all the models working together to provide a set of solutions.

Simulation is an imitation of reality. Simulation of a system involves the manipulation of a model (a representation of reality) to yield as true a picture of reality as possible. Model manipulation allows alternative policies and decisions to be tested to eliminate expensive trial-and-error methods.

A simulation requires data on how various operations are interrelated, as well as a time frame for the different conditions and objectives to be examined. By using multiple iterations of a designed model, a simulation allows examination of the different phases of a system.

VI.2 Communications in environmental management

Rodman T. Davis *

In the New York metropolitan area we are working on a project which involves both technology transfer and environmental management, primarily as it pertains to the techniques of telecommunications. Specifically it is a television system that was built by the Metropolitan Regional Council in the last several years.

Extremely fragmented jurisdiction

The metropolitan regional council is a small voluntary council of governments serving essentially a tri-state, twenty-two county metropolitan area, 8,000 square miles in size, with a population base of 18 million people. We have 50 general purpose governments, and another 800 special districts. This is an extreme example of jurisdictional and administrative fragmentation. It is a type of fragmentation similar to other large metropolitan areas, particularly in eastern parts of the United States.

The Council of Government concept is fairly well known. Essentially, it is an attempt to fill the vacuum which has developed in relation to intergovernmental relations and Constitutional definition of what states, local governments, and the federal government do. With the exception of the Metropolitan Council of the Twin Cities, Council of Governments are still tentative, administrative mechanisms designed to improve coordination between jurisdictions in the metropolitan area.

A few years ago our organization visited with a county in New Jersey. They were deliberating about putting in closed circuit television in a court system. Anyone who has served on jury duty in the last two or three years in a court system in a large city probably appreciates the problems faced in these systems. There is an incredibly inefficient and counterproductive use of peoples' time and energies. Since closed circuit television between buildings and between court systems is feasible, the possibility exists that communications technology may be used for improving the flow of information between jurisdictions, between administrative agencies or between administrators in a large metropolitan area.

In 1969 we prepared a brief feasibility study of the present state of the art in closed circuit television technologies. It was not sponsored by the central research and development oriented federal agencies or foundations which have stated interest in communications. Rather, the sponsor was a regional office of a federal agency which was aware of the lack of coordination between and among jurisdictions in the area of, among other things, the environmental management problem.

Wireless closed circuit TV

The results of the study indicated that there was a technology, known as IFTS (Instructional Television Fixed Service). This is a technology of microwave television, whereby the signal goes through a converter, into a dish antenna kind of configuration, and then through the air by line of sight ten, twenty, or thirty miles, depending upon topography, and is received by a dish and converted back to a television set.

The Federal Communications Commission (FCC) opened about thirty-one channels in the 2500 megaHertz frequency about 1963. Construction of the first systems began in the mid-1960's. For instance, in 1964 there was one that started in Mineola with six schools tied

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*Presented by Rodman T. Davis, Director of Planning, Metropolitan Regional Council of New York City, at the National Conference on Managing the Environment.

together. Then universities instituted a system in, for example, extension courses for engineering students, whereby they could stay in their factory or their firm and take courses during the working day or in the late afternoon, with some kind of audio talkback capability.

Then it spread into the hospital world. Massachusetts General Hospital has a system linking the teaching hospital, the veteran's hospital, and Logan Airfield. Some of the medical schools have also used this technique and a police system has initiated a microwave system.

Our role in relation to environmental management is to try to improve the collective decisions and improve the flow of information between a large host of federal, state, and local agencies which have specific missions in the environmental protection, environmental planning, and the administration of environmental control programs.

After selecting the system, we contacted the FCC. Basically, we proposed to build a closed circuit TV system which would link the administrative headquarters of the major counties and some of the major cities in the metropolitan area. That was the concept. It included two-way communication. This had not been done through the traditional use of ITFS closed circuit television which was primarily classroom instruction. Initially, we had a problem in soliciting participation from a builder and a system designer. Prior to that, we had to contact the FCC and explain that we were not a school district, but rather a Council of Governments, and that we were interested in governmental management and in improving the programming of governmental programs. This did not necessarily fit into their traditional categories of licensing.

Test system work begins

However, since the school systems had not used up all the channels in our metropolitan region, the timing was in our favor, and the FCC said, "Sure, try it out. It might work." We were able to get the authorization to go ahead with seventeen points in the metropolitan area in September of 1970. At that point, we started to prepare fairly detailed path surveys. If you intend to use the microave-type closed circuit system, you need either a mountain or a tall building to provide unobstructed paths between points. It is meant to be a fairly cost-effective technique as opposed to cable, which may be a very expensive way of getting television, either one-way or two-way, between points. We selected the 110-story World Trade Center and moved in during September 1971.

At this point we were surprised to receive only three fairly good bids on this system. Two of them were general contractors and would farm out different pieces of the system. We found few people who could design, package, and deliver a bi-directional or interactive closed circuit television system oriented towards governmental management.

The firm which had the most experience in total systems was selected and construction began in June of 1972. A construction strike in New York City slowed us down, but we were successful in obtaining nine closed circuit facilities built into governmental office buildings, primarily county headquarters, during the summer and fall. The dishes and the antennas on the roof of the Trade Center were placed in the winter. Presently, the system is about ninety-nine percent complete.

We are scheduling initial test transmissions in June of 1973 when we will be able to call a meeting of the air pollution administrators at the county, state, and federal level. They can collect around the various points in the region—White Plains, Mineola, Newark and New Brunswick, for example—and have a live, two-way, bi-directional discussion.

System offers vast potential

There are several related potential uses for the system. First, each of these trunk systems could feed out in an omnidirectional pattern to branch offices, like borough halls or village halls, fire stations, police stations, hospitals, and neighborhood community centers. It has a networking capability, but it is not broadcasting. Unlike the entertainment industry, large numbers of people are not involved. Secondly, there is the microwave system to a cable television potential for relating material from the system.

Related to this technique is the potential for facsimile transmission, as well as for data transmission. Our strategy, though, was not to get involved with data transmission systems at present but to concentrate on a management teleconferencing technique, which would bring the decision makers at the state and the local government together on a periodic, real-time kind of basis where we could have them continue monitoring specific progress and specific projects within their administrative purview.

Local government wants control

We learned several things. One is that local governments will respond to the offer of communications technology only when they believe that they can have some control over it. Local governments, particularly smaller local governments, are very reluctant to buy a system which "comes from above."

Secondly, we learned that bi-directional television is probably profoundly different than what we usually think of as television. We are used to being only the receiver of a television image. This is a problem when you start putting people in rooms connected by di-rectional television. The predisposition of many people to perceive these systems as entertainment must be overcome.

Thirdly, although you may offer the most beautiful system on paper, most people will not buy into a system on the basis of the description. Government officials want to see how the communications system works, and see what the mayor of the other town got out of it, before committing their own resources.

There are four general kinds of barriers that we experienced in the three years from conception to actual construction. First, the potential users and the local administrative agencies often lack an understanding of how to effectively utilize a new communications system. They need time and assistance to discover how to make the system responsive to their needs.

Second is the inadequate financing techniques for aggregating markets. We are basically running a user-oriented, user-paid system. Each local government will contribute $14,000 per year. We are not billing per hour nor per minute. Beware of "off-the-shelf technology." Although it may be available, it also may be left over from a previous era of application. In our particular case, much of the hardware we are working with is instructionally oriented, that is, teacher-pupil oriented. This is logical, because it was organized initially for use by school systems. However, when fifteen mayors, for example, are talking about recent sulfur dioxide regulations of the state environmental protection agency, they are going to make different demands on the system than students and teachers.

Avoid overambitious design

Another barrier is that communication system designers and manufacturers have a propensity to work with large systems. The users, particularly managers and administrative users at the state and local level, think in terms of small increments of investment and small steps toward progress rather than in terms of systems. In addition, implementing a large system extends the time lag between system design and system utilization. We might have approached the problem by exploring the possibility of obtaining a two-way TV set in front of every one of the 550 local governments. This would be a total system concept. Instead, however, our approach was to install the system in ten major counties and cities, and demonstrate its operation to area mayors and managers.

Finally, in terms of television as a technology, we found a need for more transparent kinds of systems. In other words, if the hardware in any way impedes or gives the impression that it is limiting the dialogue or the bargaining or the debate, it becomes less useful and less flexible for the administrator.

Ours is a time-shared system which means that we are going to be opening up different kinds of relations between jurisdictions and departments of one kind or another. This creates some difficulties. For instance, law enforcement agencies sometimes fear sharing the system with other departments.

Finally, we attempted to build a flexible system that could tie into other communication systems, such as cable, and could adapt to new systems as they may be developed.

Digging out of the data pile

In conclusion, we found that local governments are bombarded with all kinds of either contradictory or noncohesive information related to environmental management. If you ask a mayor of a city or a county official, it is fair to say that we have incredible amounts of information in our administrative system, but it is not presently comprehensive, cohesive, nor communicated so that systematic decisions may be made. Our region has begun to address this problem by utilizing innovative communication technology.

VI.3 A prototype state environmental information center

Dr. Robert V. Garner *

The Oklahoma Environmental Information and Media Center (OEIMC) was established by action of the Oklahoma Legislature and the Oklahoma Regents for Higher Education. Its purpose is to provide an environmental knowledge base for all interests in the state, including business and industry, education, government, and the public.

Action establishing the center was taken after a state-wide environmental action plan study indicated that one of the most pressing environmental needs concerned environmental information and data. There was no central authority or source upon whom the potential information user could depend for current, factual environmental information. Locating and acquiring much needed information was beyond the operational and financial capability of a majority of Oklahoma users.

The original state funding for the first year of operation was supplemented during the second year by grant funds from the Environmental Studies Division of EPA. The federal funds allowed continued development of the center.

Identification of needs

Needs were defined by target groups within two broad categories. The categories were (1) short range, i.e., problem solving, enforcement, training, etc.; and (2) long range, i.e., educational, continuing research, public information, etc. The first category, short range needs, includes the following areas: (a) environmental management information for small industry and local government; (b) environmental information required by local and state government agencies for enforcement measures; (c) environmental training materials required for industry and governmental training programs; (d) environmental information necessary for the research activities of industry, academia, and government; and (e) general environmental information solicited by the public on significant environmental issues.

The second category, that of long range needs, includes the following areas: (a) environmental information for curriculum building—an urgent need in both public and higher education; (b) general environmental information sought by special interest groups and others engaged in support of environmental quality efforts; and (c) environmental information for the planning activities of those governmental and industrial representatives charged with creating future environmental quality programs.

Building the base

Once the needs were defined, an effort was made to identify information/data bases containing environmentally related materials, and to find ways to tap those bases. Caution was taken to avoid duplication of effort. The following steps were taken: (1) Arrangements were made to allow direct access of OEIMC information personnel to the Robert S. Kerr Environmental Research Lab Library, the East Central State College Library, and other libraries with appropriate holdings; (2) Acquisition of selected environmental documents and materials was begun. Formats included hard-copy documents, microfiche, abstract listings, films, film clips, slides, etc.; (3) Contract and liaison arrange-

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ments were made with other information centers to receive selected environmental materials in microfiche format on a monthly basis; (4) Subscriptions to a number of document abstract sources were initiated; (5) Subscriptions to periodicals, newsletters, journals, etc. were initiated; and (6) A referral list of environmental expertise was begun.

Search and delivery

Though computer searches are available under some of the contract arrangements, the cost factor with current budget level is virtually prohibitive. Therefore, virtually all information searches are performed manually by environmental science students.

Delivery techniques vary considerably. The key word is service, and the center tries to provide a service in answer to all requests for information while also using media methods to disseminate environmental information. Briefly, there are five kinds of services:

(1) *Problem or question-oriented requests.* Such requests may be handled by phone, mail, or in person. They vary in depth from questions which can be answered immediately from reference materials to some which may require search of thousands of document titles and abstracts.

(2) *Field Service.* The field service is designed to provide a direct interface with the local government and small industry. The field representative is available to inform potential users of the center's services, assist in obtaining access to the center's resources, and on occasion, advise the user on applying the information.

(3) *Public information education displays.* Directed at informing the general public, this method is employed by setting up displays at environmental, scientific, educational, and industrial meetings around the State.

(4) *Publication of periodicals and fact sheets.* OEIMC publishes "ECO SYSTEMS", an environmental periodical, eight times per year, and produces fact sheets on environmental subjetcs for mailing and for handout at meetings.

(5) *Use of news media.* With an experienced newswoman on the staff, OEIMC makes frequent use of newspapers. The TV and radio media have also been used on a number of occasions.

Future directions

Even though manual search techniques have been proven more relevant and effective than computer searches, the increasing volume of requests necessitates the use of some automation.*

Since the advantage of the manual search results from the individual's ability to scan the text of an abstract or article, OEIMC studied several automated systems advertising free text-search capability. All but one of the systems studied require a large computer and considerable software. The one system which did not require a large computer showed the most promise. Based on a special purpose machine employing a hardwired associative logic, the system will search on word combinations or whole phrases. Limited software is required for storage, none for retrieval of free text. It is accessed by keyboard, it is compatible with most computer systems, and it can accommodate remote terminals. Cost per query is lowest of all systems studied. Of four units in the world, only two are now in the U.S. One is currently on loan to OEIMC. Plans are under way to purchase a complete system with peripheral equipment to allow service to the entire state.

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*NASA Report NASW-2085—A Study of NASA Literature Search Strategies, and NASA Report NSR 37-004-008—Technology Utilization in a Non-Urban Region.

VI.4 Arizona trade-off model: a tool for state growth and land-use policy*

The Arizona Trade-Off Model (ATOM) is an operational environmental management tool that analyzes economic growth versus natural environment policy issues. The model is designed to assess the impact of specific policy or program alternatives on the economy and environment of Arizona.

To measure trade-off, the model uses employment as a rough indicator for economic change and a composite index for measuring environmental quality units. The environmental composite index is derived using weighted scores for sixty-six variables representing environmental quality. The sum of the highest values for the sixty-six variables, or a perfect score of 1000, represents zero pollution. This method allows for a crude quantitative measurement of environmental quality as well as integrating policy issues into the weighing scheme.

Splitting the Atom

The Atom has two distinct stages—an exogenous or external stage and an endogenous or internal stage. The exogenous stage allows for variables that are outside the model's determination to have a value assigned. The endogenous stage is the working Atom model and uses the external factors to calculate a solution. The final evaluation phase of the Atom model uses the technique of simulation. Since internal variables may change and affect the final solutions, the ATOM is considered a dynamic simulation model.

Two of the more important aspects of the ATOM are land use and resources analysis. Land use is analyzed for each six-by-ten-mile grid cell for the state. Each grid receives a general classification of its surface resources, a distribution for the major types of activities, and a description of the grid's attributes.

The major surface resources are described by using the classifications of: surface water; riparian; urban land; cultivated and pasture; coniferous forest; grassland; woodland; chaparral and mountain brush; northern desert shrub; non-urban highways and airports; and southern desert shrub.

Human activity is also described. Items such as urban settlements, recreational facilities and activities, agricultural activities, and mineral extractions are used to relate human activities to land attributes. The land atributes that are considered include: land ownership, mineral deposits, game birds, and recreational demands. Items such as recreational demand, that change over time, have detailed computations made on the activity in each cell.

The analysis focuses on environmental quality and calculations are made for changes that would occur because of industrial emissions or increased population. Water and air effects are traced from cell to cell until they are dissipated.

The Arizona Trade-Off Model is extremely complex. There are various internal effects and interactions that are impossible to trace in a summary type paper. However, the model is providing environmental managers with information needed to establish policies and directions.

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*Based on a paper by C. W. "Jick" Myers, Arizona Department of Economics Planning and Development, and Progress Reports submitted by Battelle Columbus Laboratories. The Arizona model is being developed for the Department of Economic Planning and Development, State of Arizona, by Battelle. The Arizona program is being sponsored in part by the Four Corners Regional Commission and the U.S. Department of Commerce.

The model does have many limitations in its built-in assumptions, exogenous needs and simplistic causalties. But the model is a beginning for rational environmental decision-making.

Why Arizona?

Arizona faces several somewhat unique circumstances with regard to development. First, much of the recent growth threatens the very resources that have stimulated economic and demographic expansion. Second, the State contains a dual economic structure. The urban areas of the State are rapidly expanding both economically and in population while rural parts of the State contain severely depressed areas and are often characterized by outmigration The implication of this fact is that Arizona must continue to actively pursue economic development programs. Total disregard or even discouragement of economic growth must not be allowed to occur as long as the depressed areas exist and economic prosperity is desired for these areas. On the other hand, Arizona, which must remain aware of the impact of development programs on the State's economy, must not lose sight of the fact that the nature and quality of its environment is one of its greatest assets and must be preserved.

When the issues of economic growth and environmental quality are considered jointly, it becomes apparent that possible conflicts exist between programs for environmental improvement and policies aimed at stimulating real economic growth. Compromises must be made as policies are adopted and programs implemented. It is also clear that we lack adequate information to assure that policy and program conflicts are resolved in a manner that will maximize the total well-being of the population. The trade-off model approach provides a method for both determining data needs and for providing decision makers with the information required to formulate rational compromise.

Why was Atom developed?

The major objective of the model is to serve as a tool for use by decision makers in evaluating the trade-offs and relationships between potential economic development, environmental quality programs, and trends in the State of Arizona. It was recognized that not all questions concerning these relationships could be completely answered during the initial development of the model. Therefore, the model is constructed in a modular framework so that critical elements can be modified and updated as the state of the art improves. Emphasis also has been placed on developing a model that can be easily manipulated and utilized, thus increasing its potential usefulness by decision makers.

Although the development of the model relating economic growth to environmental quality is the prime objective of this project, other benefits include:

- An examination of how development policies and objectives are related to economic growth and environmental quality.
- The specification of means for implementing objectives.
- An analysis of environmental impact of specific industries and households.
- An analysis of the economic impact derived from public investment.

Underlying concepts of Atom

The model focuses on economic growth, demographic growth, and environmental quality. Economic growth is measured in terms of changes in employment by industry, changes in the size of the labor force, and unemployment rates. Demographic growth is measured by both migration and natural increase. Evaluation of environmental quality is generated through application of quantifiable as well as subjective measures of ecology, pollution, aesthetics, and human interest. The tradeoffs between economic growth and environmental quality are measured in terms of economic opportunity costs. In doing so, the intangible benefits of an improved environment can be balanced against problems caused by economic growth.

Before describing how the Arizona Trade-Off Model operates, it is appropriate to note briefly several of the general economic and environmental concepts on which the model is based.

(1) The economic evaluations or indicators used in this model are based on the concept of changing levels of employment. In other words, the economic evaluation of a particular decision or change in local conditions will be based on the concept of changes in total employment associated with changes in certain selected growth industries which are of most importance to the state's economy.

(2) The economic elements and interactions of the model will be based in part on selected macro- and micro-economic level concepts. Macro-economic factors include such phenomena as matching industry requirements with regional resources and regional development programs. When more precise information is required, micro-economic factors utilized include site selection factors, production functions, excess capacity, and firm investment decisions.

(3) Development policies and programs evaluated in the Arizona Trade-Off Model are assumed to successfully stimulate the economy to the desired level. The model assumes that once an investment is made, a resulting increase in jobs will not be analyzed in this model. Established mechanisms for stimulating growth will be specified, and the results assumed to follow directly from these programs will then be factored into runs of the model. The model also assumes that, in most cases, some type of new economic development is possible no matter how stringent the environmental standards that are being maintained. Therefore, the model attempts to initiate new activity in sequential order from the most economically feasible to the least.

(4) The concept of environmental quality means something different to each member of society. Therefore, to determine any change in environmental quality and the significance of the chanfie, the environment is defined in a broad context. The impacts of various economic development and environmental policies will be measured in four major categories:

A. Physical - Chemical Pollution — Quantifiable
B. Ecology
C. Aesthetics
D. Human Interest

These categories are incorporated into Atom as environmental constraints on the type and extent of economic development in Arizona. The constraints can be used to modify the growth that is desired in the state, county, or city, or be used to set environmental policies such as improvement of environment quality in the state, county, or city.

(5) Two types of constraints will be used in the Atom to assess the feasibility and desirability of economic development. These include physical-chemical constraints and land-use constraints.

(A) *Physical-Chemical Constraints.* The waste released by an industry or population has impacts on the air, water, and land of Arizona. These impacts are traditionally measured by changes in physical-chemical parameters such as BOD, SO_2, SS, etc. which may be allowed to enter the environment and by changing these allowable levels, various environmental policies can be introduced into the model.

(B) *Land-Use Factors.* The location of an industry or population centers, its design, and the amount of waste released at a site have impacts on the aesthetics, ecology, and human environment. A detailed-site specific environmental analysis can measure the direct impact of these components. Because site-specific, geographic detail is not practical at the present level of model development and these categories cannot be related directly to development, as is achieved in the physical-chemical category, a macro-environmental approach is used. This approach incorporates these semi-quantifiable components into Atom through special land-use factors. The other three categories of the environment, aesthetics, ecology, and human interest, will be transformed into "land-use" factors. Therefore, a constraint on aesthetics, ecology, or human interest will be implemented in the model by constraining the type of and extent of land use allowed in a particular location in Arizona.

(6) It is important to remember that the model, per se, is oriented toward generating trade-offs as output. Therefore, the central focus of the model is trade-offs, but in the form of output rather than an integral part of the model. Atom should be viewed as a tool for use by decision makers rather than a definitive, optimizing model. In no way is the model being constructed to yield an optimal solution. An optimizing model implies that the relationship between environmental quality and economic change is known. The focus of Atom implies that this relationship is not known and that relationship is not necessarily a constant.

(7) Causality is addressed in those areas critical to evaluating trade-offs between environmental quality and economic change. In particular causality will be stressed in issues relating economic change to levels of physical-chemical pollution; changes in land use to changes in ecological, human interest and esthetic environmental issues; and environmental constraints and standards to acceptable levels of economic activity.

How does Atom work?

In general terms, the Arizona Trade-Off Model is a system of related submodels. Evaluations of economic and environmental change and impact are performed either by means of a dynamic situation procedure or by evaluating the impacts of projects and policies at a given point in time. Within the overall system framework, some of the model elements are internal and some external to the actual trade-off evaluation. This is most easily explained by references to the flow diagram of the model presented in Figure 1. The three external submodels are concerned with the generation and specification of data, instructions, and parameters of the computer-based trade-off model.* The trade-off section of the Arizona model (elements 5-14 in Figure 1) consists of a set of functionally linked submodels which interact during a particular run or simulation to describe the economic and environmental impacts of a particular policy decision.

External components

The external components of the system range from a complex economic model to a substantive data bank.

STEP 1. Public policy

The first step, shown in Figure 1, is called a public policy submodel. The first task in the use of the model is to delineate specific policy alternatives or methods of implementing them. Numerous state, Federal, and private organizations are promoting economic development while certain of these same agencies and many others are advocating environmental constraints, programs, and objectives. Atom will identify these Arizona agencies, clarify their missions, and identify the various comprehensive economic and environmental policies of relevance in Arizona.

Given the comprehensive economic or environmental policies and applied objectives, potential programs for implementation to achieve these objectives must be identified. Then, the cost of implementation can be estimated,

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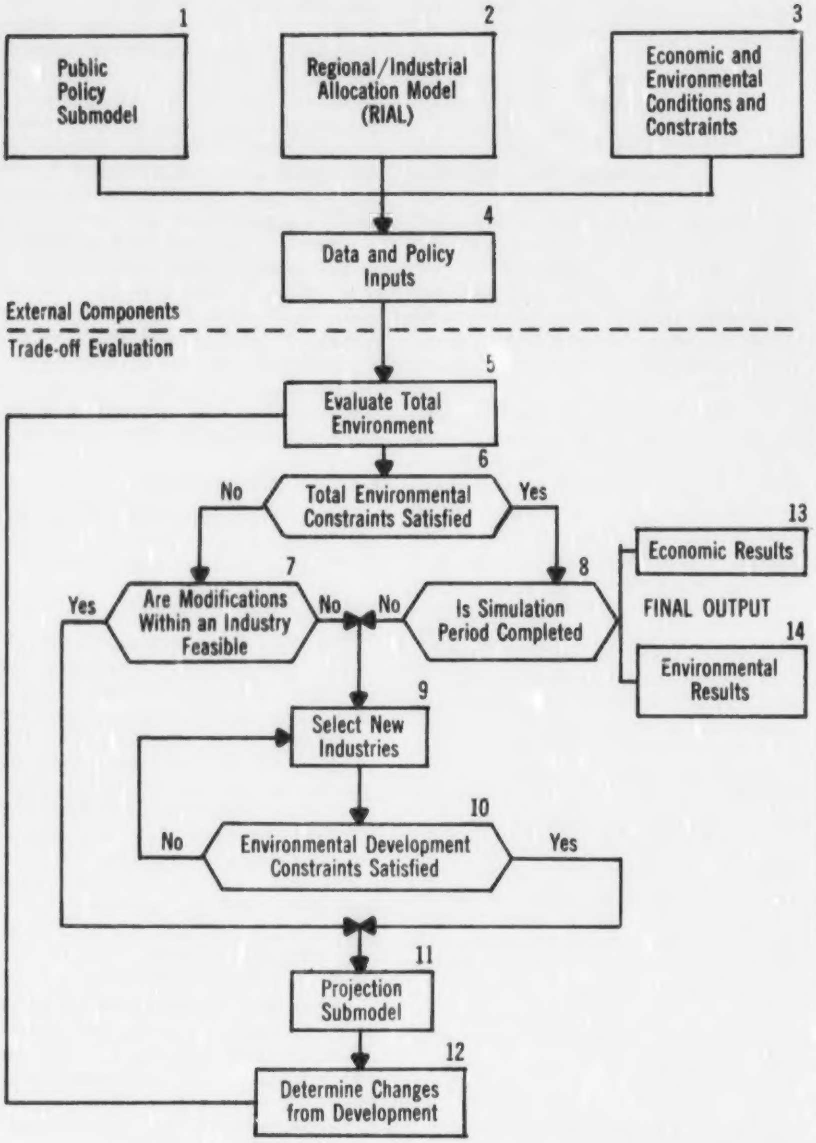
* Unlike the elements of the trade-off portion of Atom, the external submodels are not operationally linked to each other or other elements.

FIGURE 1.—FLOW DIAGRAM OF THE ARIZONA MODEL


1
Public Policy Submodel
2
Regional/Industrial Allocation Model (RIAL)
3
Economic and Environmental Conditions and Constraints
4
Data and Policy Inputs
External Components
Trade-off Evaluation
5
Evaluate Total Environment
6
No
Total Environmental Constraints Satisfied
Yes
13
Economic Results
7
Yes
Are Modifications Within an Industry Feasible
No
No
8
Is Simulation Period Completed
FINAL OUTPUT
14
Environmental Results
9
Select New Industries
10
No
Environmental Development Constraints Satisfied
Yes
11
Projection Submodel
12
Determine Changes from Development

and, if desirable, placed within a framework of the total budget available. The output of this submodel includes the type of programs to be implemented, and the location and the timing of the results associated with them.

STEP 2. Regional/Industrial Allocation model (RIAL)

The identification of the industries best suited for various locations is a two-sided process in the Arizona model. The initial step involves the use of RIAL to identify industries which are feasible for individual Arizona counties. The Regional Industry Allocation model relates industry needs to regional resources. Use is made in this model of input-output linkages and the identification of both industry location requirements and the resources of a specific area. Factors used in this analysis include the following industry and county characteristics:

> *Industry characteristics*: Raw material supply orientation, intermediate supply orientation, other supply orientation, intermediate market orientation, and consumer market orientation.
>
> *County characteristicss* Raw material availability, intermediate material availability, other material availability, intermediate market potential, and consumer market potential.

A ranked list of the most feasible new industries for each location is provided.

The industry feasibility list is only that and no probability measure of likelihood of actual location is attempted. The model makes no attempt to compare the desirability of competing locations for any industry. Proposed development programs must be assumed successful in testing possible impacts because regional science has not yet provided us prescient capacities in the field of industrial location.

The second phase of the industry location process, Step 9 "Select New Industries," examines the likelihood for attracting one of these industries to the county and identifies desirable and suitable locations for a suitable industry (as identified by RIAL).

STEP 3: Economic and environmental constraints

The third major external unit is a data base of existing economic, demographic, and environmental characteristics. These data are used both for operation of the analytical procedure and as a base against which to gauge changes resulting from the implementation of policies and programs.

Two types of data will be developed: characteristics of economic activity and regional characteristics. For each possible category of economic activity, data describing its locational and operational characteristics will be entered. This would include, for example, number of production workers, skill level, dependance on rail for shipping, and the like.

Existing environmental quality is measured in Atom by a composite index value derived from the evaluation of sixty-six variables (see Table 1). Each parameter is weighted based upon its importance to total environmental quality. The method begins with 1,000

TABLE 1

I. ECOLOGY (315 units)

A. Species and Populations (144 units)
  1. Rare and endangered plant and animal species (16)
  2. Productive plant species (16)
  3. Game animals (16)
  4. Other animals (16)
  5. Resident and migratory birds (16)
  6. Sport fisheries (16)
  7. Commercial fisheries (16)
  8. Pestilent plant and animal species (16)
  9. Parasites (16)

B. Habitats and Communities (96 units)
  10. Species diversity (48)
  11. Food chains (24)
  12. Land use for habitats and communities (24)

C. Ecosystems (75 units)
  13. Productivity rate (25)
  14. Hydrologic budget (25)
  15. Nutrient budget (25)

II. ENVIRONMENTAL POLLUTION (321 units)

- D. Water Pollution (160 units)
  - 16. Algal blooms (5)
  - 17. Dissolved oxygen (20)
  - 18. Evaporation (6)
  - 19. Fecal coliforms (5)
  - 20. Nutrients (12)
  - 21. Pesticides, herbicides, defoliants (8)
  - 22. pH (8)
  - 23. Physical river characteristics (6)
  - 24. Sediment load (15)
  - 25. Stream flow (20)
  - 26. Temperature (20)
  - 27. Total dissolved solids (20)
  - 28. Toxic substances (5)
  - 29. Turbidity (10)
- E. Air Pollution (40 units)
  - 30. Carbon monoxide (8)
  - 31. Hydrocarbons (8)
  - 32. Particulate matter (8)
  - 33. Photochemical oxidants (8)
  - 34. Sulfur oxides (8)
- F. Land, Pollution (93 units)
  - 35. Land use and misuse (31)
  - 36. Soil erosion (31)
  - 37. Soil pollution (31)
- G. Noise Pollution (28 units)
  - 38. Noise (28)

III. AESTHETICS (159 units)

- H. Land (25 units)
  - 39. Land forms (15)
  - 40. Geologic surface material (10)
- I. Air (11 units)
  - 41. Pleasantness of sounds
- J. Water (29 units)
  - 42. Surface characteristics (25)
  - 43. Water-land interface characteristics (14)
- K. Biota (28 units)
  - 44. Vegetation (18)
  - 45. Fauna (10)
- L. Man-made Objects (21 units)
  - 46. Visual
  - 47. Conditions
  - 48. Consonance with environment (8)
- M. Composition (35 units)
  - 49. Interaction of land, air, water, and manmade objects (25)
  - 50. Color (10)

IV. HUMAN INTEREST (205 units)

- N. Educational-Scientific Significance (64 units)
  - 51. Geological significance (18)
  - 52. Ecological significance (18)
  - 53. Archeological significance (18)
  - 54. Unusual water phenomenon (10)
- O. Historical Significance (55 units)
  - 55. Related to persons (11)
  - 56. Related to events (11)
  - 57. Related to religions and cultures (11)
  - 58. Related to architectures and styles (11)
  - 59. Related to western frontier (11)
- P. Cultural Significance (54 units)
  - 60. Related to Indians (18)
  - 61. Related to religious groups (18)
  - 62. Related to other ethnic groups (18)
- Q. Mood-Atmosphere Significance (32 units)
  - 63. Isolation-solitude (8)
  - 64. Awe-inspiration (8)
  - 65. "Oneness" with nature (8)
  - 66. Mystery (8)

Source: Battelle Memorial Institute, Columbus Laboratories:

environmental quality units as representative of a perfect score, although no area would obtain this. Data are then gathered and evaluated for each area of the state. This method is to evaluate environmental quality by quantitative standards. Also, the weighting of different qualities is implicitly a policy of variable, i.e., the user may propose alternative weighting arrangements and test the impact of each.

Data describing regional or spatial factors is also prepared, some by county and some by "cell." Information will be entered in the form of State mayors partitioned into about 2,700 rectangular grid cells by six-by-ten miles in size. Both economic and environmental factors are entered in the grid matrix.

Land-use component

Because of the difficulty of analyzing environmental quality, an environmental evaluation system was developed based primarily on land-use descriptions.

Three descriptions of the land-use area within each six-by-ten mile cell are used in Atom. The first is a general classification of surface resources. The second is the distribution of major types of activity or use and the third is a detailed description of attributes of particular sites.

A map of the state of Arizona is overlaid with six-by-ten mile grids. Then, each sixty-square-mile area is described in terms of its major surface features. There are eleven classifications used in this description. These include surface water, riprarian, urban, cultivated land, coniferous forest, grass land, chapparal and mountain brush. A given sixty-square-mile area might be comprised of thirty-four square miles of urban development, twenty square miles in cultivated land, five square miles of grassland and one square mile of highways. Thus, this method represents a macro assessment of multiple land-use features or land resources within a particular cell. The total of these surface resources must be 100 percent for every cell.

The second feature, overlain in map form, is human activities representing either current or future demands upon the use of a given land area. Human activities include such things as urban settlements and their interactions, recreational activity, agriculture or grazing, or perhaps a mineral extractive use. Overlaid to relate to both the surface features and human activities are micro-level attributes of land areas. These include such things as land ownership, mineral deposits, the existence of particular game birds or designated habitats, hiking trails, and recreational demand and supply. Many of these micro-level attributes are constant within the model; e.g., a site of archeological significance or of particular historical or cultural interest. Other attributes such as recreational demand are calculated within the model and change over time. The calculation of recreational demand is done with a separate model component which provides detailed information on activity days per cell for such things as horseback riding, hiking, picnicking, boating, camping, swimming and fishing.

As activity levels vary within the model, calculations are made of changes in environmental quality. These include the emissions produced by a new industry of a given size or of new concentrations of population, as well as additional use of a recreational area. Environmental quality factors which may be produced in one cell, yet affect quality of the environment in another cell are traced to the point of dissipation. This would be particularly true in terms of water or air pollutants. Ambient air concentrations in a particular cell will change with the introduction of a new manufacturing plant. This change probably will result in the flow of pollutants into adjacent cells. To the extent possible, given existing meteorological information for Arizona, the changes in ambient air quality for adjoining cells or through a chain of cells is followed within the model and new calculations of air quality are made for each of these cells, resulting from the additional activity in the first.

STEP 4: Data and policy inputs

The data input step, listed in the flow diagram as number 4, is not actually a separate model component. It merely illustrates that a selection process is necessary for input into the actual analysis procedure. Those data input will almost always include public policy or program definitions and the most complete description available of both economic and environmental characteristics of a particular area.

Land resource and use data are input in map form, making use of the six-by-ten mile grid cells. The grid size is arbitrary and can be changed if desired. A major difficulty with data used in this type of analysis is that much of the economic information is available only at a county level, whereas environmental characteristics are mostly site-specific. The economic data, therefore, are distributive algorithms where necessary. For the most part, reasonable distributions have been possible on the basis of known concentrations of population or activities.

Trade-off evaluation

The actual evaluaion of trade-offs: i.e., the economic and environmental consequences of policy actions, is conducted through the use of an overall framework comprised of several linked submodels. These are in figure 1 as steps 5 through 14.

STEPS 5 and 6: Evaluate constraints

The first step of the actual computerized trade-off model is to determine if the total economic and demographic development meets specified standards set for environmental quality (see figure 2). A detailed picture of the total environment is derived from the sum of all economic and demographic development in a specific cell. Interlocational impacts are also included, e.g., if an upstream plant of some type is causing air pollution, it must be considered in describing the environment of a downwind community.

The simulated success of new economic growth is also tested against a given set of environmental constraints. It is possible to simulate the aggregate impact of a new level of economic activity, and its associated waste generation against both land use and pollution constraints. If these constraints are violated, several options are available. One is to select different industries which would be more compatible with the environment. A second is to modify the existing level of industrial pollution through the imposition of specific controls which can be met by industry, and a third might be to revise certain of the environmental constraints.

One of the important features of the model is an ability to evaluate the efficacy of industrial dispersion as a means of environmental improvement. The Regional Industry Allocation Model (RIAL) furnished a list of industries most feasible for a given area coupled with the ability to evaluate the environmental impact of different structures. However, it must be emphasized that the model does not address the question of economic efficiency in RIAL, nor does it pretent to suggest that a different locational organization is practical.

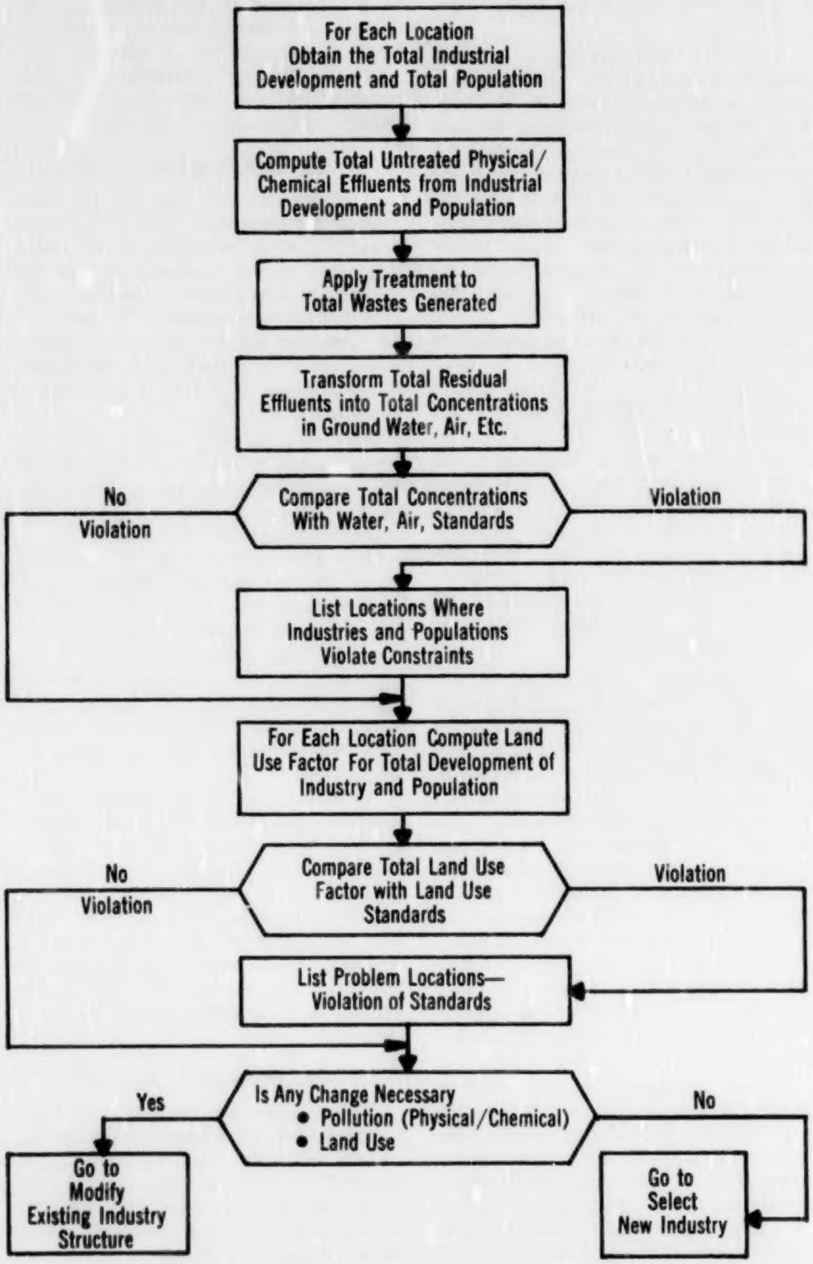
STEP 7: Modify industry structures

The purpose of this submodel is to make the changes necessary to industries when the evaluation of the total environment indicates that certain environmental parameters are being exceeded and identifies the types and location of the violation. The question to be answered is how to modify the existing structure so the environmental constraints are satisfied. The first step is to determine if pollution abatement equipment will alleviate the problem. If abatement equipment will not work, the industry will be forced to reduce production and therefore reduce employment. If abatement equipment will work, the cost and the method of financing are analyzed.

STEP 8: Simulation periods

The simulation is geared to a ten-year future result; however, it allows the user to select a time period and to trace the impacts of policy changes annually or even quarterly in some cases by successive iterations of the model. As illustrated in the schematic flow diagram in figure 1, the model always repeats the step 5 evaluation of the total environment after a policy induced

FIGURE 2.—PROGRAM "EVALUATE TOTAL ENVIRONMENT"


For Each Location Obtain the Total Industrial Development and Total Population
Compute Total Untreated Physical/Chemical Effluents from Industrial Development and Population
Apply Treatment to Total Wastes Generated
Transform Total Residual Effluents into Total Concentrations in Ground Water, Air, Etc.
Compare Total Concentrations With Water, Air, Standards
No Violation
Violation
List Locations Where Industries and Populations Violate Constraints
For Each Location Compute Land Use Factor For Total Development of Industry and Population
Compare Total Land Use Factor with Land Use Standards
No Violation
Violation
List Problem Locations—Violation of Standards
Is Any Change Necessary
• Pollution (Physical/Chemical)
• Land Use
Yes
No
Go to Modify Existing Industry Structure
Go to Select New Industry

change. Steps six, seven and eight are then repeated before the final output is produced.

After one complete cycle (steps 5 through 12) of ATOM, a feedback loop results in the execution of the Evaluate Total Environment submodel. Following this step, the question is asked "Is the simulated period completed?" If the 6th year of simulation of a 10-year test has been completed, the model continues to simulate four more annual evaluations. If, on the other hand, the 10th year of a 10-year simulation has been completed, ATOM prints out final output in the form of environmental and economic impacts.

STEP 9: Selection of new industries

Once the existing economic and demographic structure has been evaluated in terms of environmental constraints, changes in structure made, or the need for new industries specified, the model begins the process of selecting new industries and activities required to meet the economic development objectives.

The selection of new industries encompasses several tasks. The first is to determine the overall level of new activity required to meet economic growth objectives. The natural growth which will probably occur is determined earlier in providing a set of baseline projections. A difference between this and a target rate of growth results in the need to select new industries from the ranked list previously determined by the Regional Industry Allocation Model. Although this model does not consider comparative advantage, it is a valuable tool in allowing the user to examine feasible alternatives for industrial structure.

A key component of the selection process is determining the best location (by cell) for an industry. Among the factors considered are: labor force; transportation; industrial sites; educational facilities; institutional factors (e.g. taxes; government policies); agricultural potential; and recreational potential. Once the best location is chosen, it is examined to see if that activity violates any environmental constraints, such as land use or air pollution constraints. If any environmental constraints are exceeded, the model attempts to relocate the activity.

STEP 10: Development constraints

The objective of this ATOM Submodel is to test for the environmental feasibility of an industrial development suggested by the economic part of the model (Figure 1). It is assumed that, if a development is unfeasible either by its violation of the physical-chemical constraints or land-use constraints, when summed with other developments, it remains unfeasible.

For each industry used in the Arizona model, a profile is developed of the waste that it generates. These raw wastes are then subjected to "treatment" to determine the effluent or residual that would enter the environment. The residuals are then converted into a concentration in the receiving environment—stream, ground water, air, etc. The resulting concentrations are compared to environmental quality standards parameter by parameter to determine if any violations exist. Violations are stored for the next economic evaluation.

Each industry is associated with a land-use factor. This land use is then compared to the desired land use at the particular location. If a violation occurs, it is recorded for the next economic evaluation. Because these land uses are a function of ecology, aesthetics, and human interest, a violation of the land use implies an unallowable impact in these categories of the environment.

STEP 11: Projection submodel

This component projects internally consistent sets of demographic and economic forecasts. This latter point is especially important because it produces accurate estimates not only of demographic impacts resulting from some changes in economic structure, but also computes certain secondary impacts and multipliers such as needed for increased employment in trade and services. Output is in terms of population, households, demographic characteristics, and employment by industry.

STEP 12: Determine changes from development

In this part of ATOM economic and regional data is updated in such a way that what occurred in one simulation or run of the model may be entered in the next cycle. A final analysis of each simulation can be made by returning to step 5 and again evaluating the total environment. The model then passes through steps 6 and 8 to the final output section where the results are recorded.

FINAL RESULTS: Economic and environmental

The consequences which result from a particular test situation will be printed out by the model in two basic forms. First, economic changes which result from an alternative policy will be described. This will provide a detailed picture not only of changes in employment but also population and the multiplier impacts which may accompany a given program.

The consequences which result from a test situation in the environmental sector will be described through the use of a special environmental evaluation system that has been tailored for use in Arizona. The impacts of a particular policy will be described in four main dimensions: ecological, aesthetic, social, and physical-chemical. A fifth community may be related to the above which relates environmental consequences to various types of urban and rural situations and social climates. Examples of ecological topics to be examined are small game, and upland birds; examples of aethestics categories to be examined are relief, vegetation types, and scenic areas. The physical and chemical considerations include sulfur oxides and hydrocarbons as well as other factors which are generally quantifiable. In the social and community areas, cultural, historic, and urban settlement patterns will be examined.

There is no attempt within the Arizona model to arrive at some optimal solution by combining the economic and environmental results. It is anticipated by producing an objective and detailed picture of the consequences of a policy decision, described in these two major dimensions, that the decision makers in Arizona will have the type of information demanded and required to evaluate economic and environmental trade-offs.

Conclusion

This presentation on the Arizona Trade-Off Model is admittedly sketchy and necessarily brief. The model is operational and provides useful information to policy makers in establishing directions. Refinements are necessary, but this would be expected in any new approach to the solution of a complex problem. Success is claimed in terms of devising a rational process for analyzing policy alternatives and providing decision makers with relevant information. The inter-relationships are amenable to a comprehensive analytical process. Causality is structured into the framework where applicable and it is believed that the Arizona Trade-Off Model, despite its initial limitations, represents a significant breakthrough in fulfilling the planning function. That is, it will give the policy makers useful information about the trade-offs between economic growth and environmental impacts which can be weighted against political and social realities in a rational decision-making process.

VI.5 EDMPS: environment-dependent management process automation and simulation

Gulf Universities Research Consortium *

This paper presents the ENVIRONMENT-DEPENDENT MANAGEMENT PROCESS AUTOMATION AND SIMULATION (EDMPAS) system in sufficient detail to permit its preliminary evaluation. EDMPAS and its major components are described in terms of those characteristics and capabilities which appear to offer unusual or improved support to operational and management elements of environment-dependent organizations.

While emphasis is placed on description of the total EDMPAS system, it is important to recognize that certain of its major software components can be put to effective use immediately as stand-alone subsystems to improve information and data management appropriate to needs ranging from purely scientific to diverse management applications.

The application of EDMPAS

Through several decades of practice, modern management has developed procedures for the acquisition of data; its conversion into management-pertinent information; and the compression of the synthesized/interpreted product into a form which facilitates rapid management appraisal and decision-making. These procedures and the associated organizational structures and functions are designed to:

—Monitor the basic agency, industry, company, etc. operation—involving, for example, demand forecast, design, construction, production, distribution, etc. — and the primary external inputs—such as financial sensitivities and controls, pertinent technological development, and institutional or regulatory controls; and

—Implement a *management level-to-data collection level* closed loop information feedback system that, after a sufficient number of iterations or "practice cycles", provides management with a continuum of compressed information developed specifically for effective organizational operation and informed decision-making.

Modern governmental and industrial management has rapidly integrated the use of computers into its strategy/policy/decision-making process. Essentially all agencies and companies of reasonable size and complexity are using computers in direct support of operation requirements and to provide information for management decision.

HOWEVER, WHEN ENVIRONMENTAL AND ECOLOGICAL SENSITIVITIES AND RESPONSIBILITIES OF THE ORGANIZATION MUST BE CONSIDERED, THE COMPLEXITY OF MANAGEMENT AND OF THE INFORMATION NEEDED TO SUPPORT MANAGEMENT IS INCREASED WELL BEYOND THE CAPABILITIES OF PRESENT MANAGEMENT PRO-

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*Gulf Universities Research Consortium is a joint research-educational association composed of universities, research associates, and affiliated companies. Excerpted from "EDMPAS," a Data/Information System for Environment-Dependent Management Process Automation and Simulation. Copyright 1972 Gulf Universities Research Consortium.

CEDURES AND THEIR ASSOCIATED AUTOMATED INFORMATION SYSTEMS. The capability to couple the effects of dynamic natural processes (e.g., the effects of environmental mass and energy exchange on pollutant concentration, or rates of living resources production as a function of natural and human processes) and related economic, social and legal considerations into the management process is currently very inadequate because: complete sets of environmental and related data are lacking; computer software capable of integrating environmental and related human process information into the data and information management systems currently supporting management procedures has not been made generally available; and the knowledge required for synthesizing, interpreting and compressing interdisciplinary management-pertinent information as necessary to support informed decision-making has not been developed.

A more subtle, but very important, inadequacy of general information management systems AS APPLIED to ENVIRONMENT - DEPENDENT DECISIONS appears to result from their dependence on statistics as inputs and the use of established probabilities to produce a "most probable" answer to management query. Unfortunately, environmental (and, therefore, environment-dependent social) data is not established with several-decimal-point accuracy; and decisions relative to the environment are made only once (or, possibly, 2-3 times with long intermediate delays) such that *probabilities do not apply*—being "right 51 percent of the time" now becomes being "51 percent right", and that is inadequate for environmental decisions.

These deficiencies should not be attacked independently. On the contrary, they are best attacked as a single coordinated effort. Since August, 1971, a multi-university Gulf Universities Research Consortium (GURC) team has been working to overcome these deficiencies. This effort has been directed specifically to the development of software which constitutes the means for effectively coupling environmental and ecological factors into management processes. However, it has been integrated with other GURC programs so that it could be conducted as a coordinated effort involving the acquisition of complete data sets (to the extent that environmental/economic/legal expertise can now define such sets); statistical and functional processing of these data; the expansion and conversion of real data to continuous-process-derived synthetic data for each type of disciplinary information and according to query-determined spatial and temporal coordinates such that interdisciplinary subset-by-subset analysis and correlation is possible; development of a completely flexible interdisciplinary data compiler system permitting immediate access to individual bits, selected subsets or complete files; synthesis and interpretation of data for application to specific real world problems; compression and display of pertinent data subsets; and use of compressed information for the design of improved data acquisition.

Therefore, the development effort has simulated many of the functions in the management information feedback loop process. The GURC team is continuing the development, integration and testing of EDMPAS. Also, in the test phases, it is involving personnel directly involved in environment-dependent problem solution.

The EDMPAS system as described herein is "14 months and $450,000 old"; hence, it by no means provides all of the software for environment-dependent management support. Indeed, except for purely environmental science applications, its *full* application depends upon its integration with existing archives, general information management systems, socio - environmental models, etc. HOWEVER, IT DOES PROVIDE THE ONLY MEANS thus far revealed to the GURC team in its survey of available data/information management systems for handling the complete spectrum of environmental and environment-dependent disciplines; merging and compressing such data as obtained from disparate data banks; integrating this capability with existing information management systems and their components; and continuously updating and expanding the system without limit and without obsolescence.

Therefore, EDMPAS in its current state of development both (1) a significant step forward as evidenced by a stand-alone on-line interdisciplinary information system with real-time capability and (2) an exceptionally effective and flexible base for continuing expansion and improvement.

Basic simulation requirements

The management of any organization of significant size involves (1) data and information flow from both internal and external sources and (2) conversion of "raw" data into information which has been synthesized, interpreted, and compressed through successive organizational levels for operational and management use. Procedures are gradually established whereby the needed data are either generated or accessed from existing sources and fed through the organization's information flow channels. Such procedures are established through successive iterations, or "trials", wherein both the management query, or information demand, and the information system response to that effectiveness are established. This management level-to-data base feedback system must operate continuously and must undergo some continuous modification to adapt to new requirements for managerial strategy and decision-making.

THE GOAL OF ANY "INFORMATION MANAGEMENT SYSTEM," THEREFORE, MUST BE THE (1) *AUTOMATION* OF THE INFORMATION FLOW NETWORK WITHIN THE ORGANIZATION AND (2) *SIMULATION* OF THOSE OPERATIONS WHEREBY DATA IS SYNTHESIZED, INTERPRETED AND COMPRESSED—I.E., CONVERSION INTO "MANAGEMENT" INFORMATION. As long as one deals with "hard data" only—i.e., compiled statistics as contrasted with dynamic processes such as those controlling environmental parameters in the management system—it is probable that many information management systems can accomplish the *first* of these functions with varying degrees of effectiveness. However, to provide the capability for either management or scientific query of both active and stored data sources of interdisciplinary data (1) on a functional relationship basis and (2) allowing time and space display according to selected grid systems, an EDMPAS type of capability is required. THE *COMPLETELY FALSE* PREMISE UPON WHICH MANY INFORMATION MANAGEMENT SYSTEMS APPROACH ENVIRONMENTAL PROBLEMS IS THAT (1) A COMPLETE "DATA BASE" EXISTS, (2) THE KNOWLEDGE NECESSARY FOR ITS APPLICATION TO MANAGEMENT PROBLEMS EXISTS, AND (3) ITS COMBINATION INTO A "MANAGEMENT MODEL" CAN BE HANDLED WITH ONE-WAY STATISTICS—in a manner similar to the computation of a "hit" probability in a baseball game based on the pitcher's ERA, the batter's hitting percentage, right-and-left-hand comparisons, etc. In environment-dependent management, neither the data nor the knowledge has been developed. Not only have there been no accurately recorded statistics taken during hundreds of thousands of games, but almost *each game is different so that statistics in the normal sense cannot be generated*—much less the functional relationships required to convert statistics into a valid strategy. Further, the time lags involved in natural and human processes prevent immediate assessment of the strategy. Determining, in even approximate quantitative terms, the effectiveness of pollution control regulation in reestablishing water quality, for example, requires many months or several years. On the other hand, the results of putting in a left-handed pinch hitter are immediately observable, and the average results of such decision are established to three decimal places. Hence, in environment-dependent management, a two-way and nearly real-time information flow automation is required such that the feedback system is affected and SUCH THAT ENVIRONMENTAL *AND* MANAGEMENT EXPERTISE CAN BE BROUGHT TO BEAR ON THE GENERATION OF AN ACCURATE SIMULATION (AND THEREFORE PREDICTION) CAPABILITY. Unlike baseball-type problems, one is *not* making decisions on the basis of unchanging rules and procedures and three-decimal-place statistics. When management decisions are made frequently, and rapid recovery or revision following a "bad" decision is possible, being "right" a majority of the time is usually adequate. In visible environmental problems, *the manager may get only one chance*—and so may the environment.

It is obvious that automation and simulation of the environment-dependent management system does *not* imply the ultimate elimination of people from the system. On the contrary, only skilled individuals can direct the automation process to achieve management-to-data base compatibility, perform the interpretive function such that data-to-information conversion and compression is possible, and keep the management information feedback loop in adjustment. The most accurate analog, or model, of a system is the system itself; hence, computerized automation and simulation in environment-dependent management must be viewed as a tool which enhances the development of knowledge regarding the interplay between environmental processes and organizational management such that an effective management skill is developed, long-range strategy acquires greater validity, and decision-making becomes more accurate.

At this point in time, it is apparent that the FOCUS REQUIRED FOR ENVIRONMENT-DEPENDENT PROBLEM SOLUTION IS AT THE STAFF LEVEL in the organization. It is at this level that instructions for data acquisition are formulated and data synthesis and interpretation are performed to accomplish the needed data-to-information conversion and compression in response to management query. EDMPAS HAS BEEN DEVELOPED BY ENVIRONMENTAL SCIENCE SPECIALISTS who are representative of those who must accomplish these functions as they pertain to environmental influences on organizational management strategy and decision-making. In carrying out this development, however, test cases were used wherein these specialists were directing a data acquistion effort followed by synthesis, interpretation and compression of information for evaluation and decision concerning specific "real world" environment-dependent problems—such as the ecological effects of deep water compatibility of the environmental information system with those systems already developed and in use for that part of organizational information feedback systems *not* involving environmental dependence such that subsequent integration with such systems was both possible and easily accomplished.

Similarly clear objectives pertained to the development of an information management system which could automatically (1) access data from established—and disparate—archives or data banks, and (2) provide input/output interface with dynamic environmental or socio-environmental computerized models. Because the "executive command" software module of EDMPAS—Environmental Information Retrieval (ENVIR) subsystem — accomplishes these objectives, INTEGRATION OF EDMPAS WITH EXISTING MANAGEMENT SYSTEMS SHOULD RESULT IN MINIMUM TIME AND COST AND LITTLE, IF ANY, OBSOLESCENCE OF THE EXISTING SYSTEM.

The logic employed

It is pertinent to discuss the logic

employed in EDMPAS development in this regard. In the interest of brevity, however, AN EXCEEDINGLY SIMPLIFIED portrayal of "normal" management structure and functions is used. Also, it is useful to project this management procedure in terms of a simplified and generalized management model; however, the model is discussed only to demonstrate the nature of environment-dependent management simulation requirements rather than to imply that such a model is either the immediate objective of EDMPAS or that it is in any way essential to EDMPAS application. On the other hand, an interplay between management models and a "living atlas" type of model input such as EDMPAS would be mutually advantageous—particularly during their development phases.

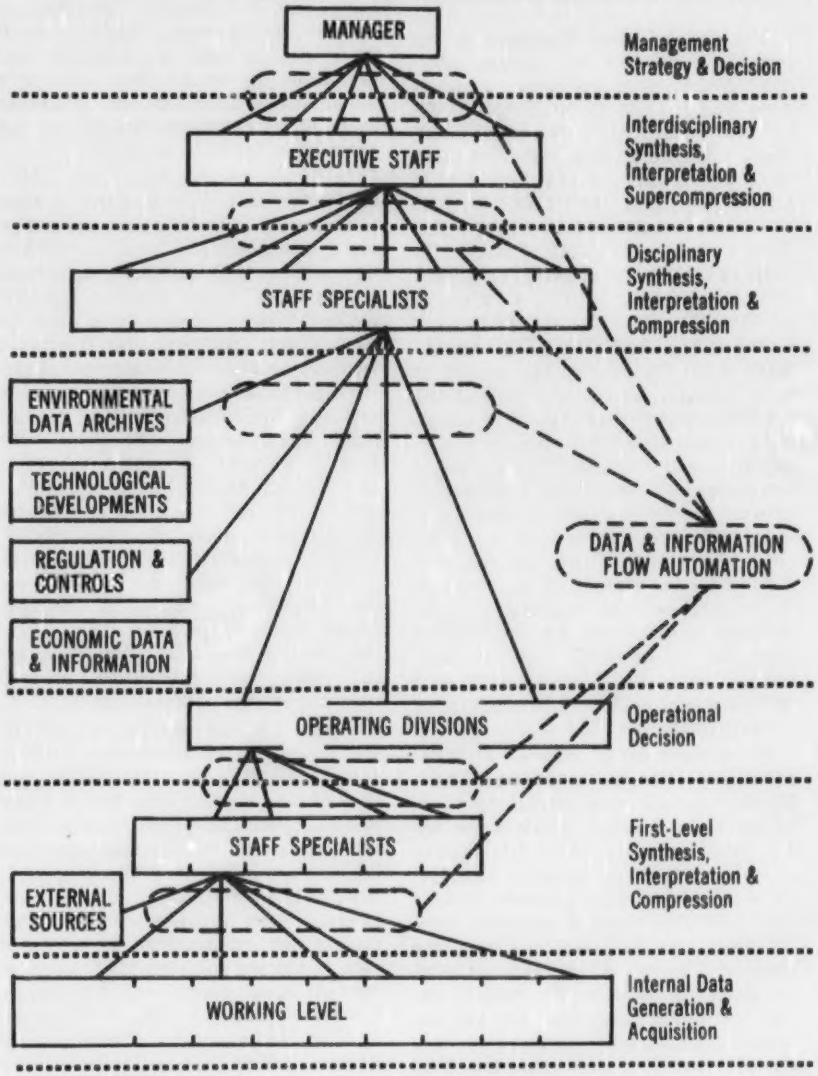
Figure 1 presents a simplified management structure which emphasizes data flow and data-to-information conversion. The lines in the diagram represent that data and information flow within the organizational structure resulting from a single query at the manager level; i.e., they indicate the usual "in-line" flow of queries from the top down and return flow of response data and information from the bottom up. The blocks in the diagram represent functions accomplished within the structure whereby data are validated and organized and then, by successive stages, synthesized, interpreted and compressed for the next level of management. The dependence on both internal and external sources of data and information is included to emphasize dependence on the acquisition of data from disparate sources.

It is pertinent to note that data "processing," "storage and retrieval," "display," etc. do not appear in Figure 1 as functional blocks. Such procedures are the *means for automation* of the data and information flow process at all levels; hence, the lines are "circled" in Figure 1 and "connected" to a Data Information Flow Automation "circle" to indicate either actual or potential automation wherever lines appear on the diagram.

The AUTOMATION of the data and information flow process by data "processing," "storage and retrieval," "display," etc. refers, then, to "computerizing" the lines in the diagram. The SIMULATION of the management *process* requires computerization of the functions performed by the blocks in the diagram. In general, this means the generation of "table functions," "control functions," "correlation instructions," etc. for correlation, synthesis, display, etc. which simulate the information conversion and compression functions in the system. Such simulation is *now* generally limited to enhancing the human management system in terms of synthesis and display for *human interpretation and guidance*. That is, it should facilitate the expert appraisal of large, complex and interrelated quantities of data and information. This permits, then, a series of queries and responses of increasing complexity and sophistication which lead to valid interpretation followed by meaningful compression. In this regard, the current status of environmental know-how is such that even scientific query of a bank of environmental data is generally either inaccurate or inadequate until a series of queries interspersed with quick graphic answers has led the inquirer to "ask the right question." This problem is multiplied manyfold when the query attempts to relate environmental to corresponding management elements of the problem.

Organizational structures as shown in Figure 1 are sufficiently standard and familiar that only certain specific points are noted: Data is fed into the system at all levels of the structure; Data compression and conversion to information occur *formally* at all levels below top management—and the conversion process occurs, at least mentally, at the top management level also; Data and information become progressively less detailed and specialized as they proceed from the bottom level to the top; Staff specialist level synthesis and interpreta-

FIGURE 1.—MANAGEMENT PROCESS STRUCTURE AND FUNCTIONS


MANAGER
Management Strategy & Decision
EXECUTIVE STAFF
Interdisciplinary Synthesis, Interpretation & Supercompression
STAFF SPECIALISTS
Disciplinary Synthesis, Interpretation & Compression
ENVIRONMENTAL DATA ARCHIVES
TECHNOLOGICAL DEVELOPMENTS
REGULATION & CONTROLS
ECONOMIC DATA & INFORMATION
DATA & INFORMATION FLOW AUTOMATION
OPERATING DIVISIONS
Operational Decision
STAFF SPECIALISTS
EXTERNAL SOURCES
First-Level Synthesis, Interpretation & Compression
WORKING LEVEL
Internal Data Generation & Acquisition

tion is generally aligned with specialized expertise—i.e., single discipline as to range—with the degree of specialization varying inversely with the level in the hierarchy; and The *key* to data/information conversion is the ability to *combine* specialized (disciplinary) summations into management information—i.e., perform interdisciplinary interpretation and compression into management display—which function is concentrated in the hypothetical structure of Figure 1 at the executive staff level.

The last of these functions is the principal bottleneck in realizing effective environment-dependent management today. THIS IS NOT BECAUSE OF AN INHERENT INABILITY OF THE SPECIALISTS INVOLVED, BUT BECAUSE OF (1) THE LACK OF COMPLETE SETS OF VALID DYNAMICALLY CORRELATABLE DATA AND (2) THE UNAVAILABILITY OF A COMPUTERIZED INFORMATION SYSTEM WHICH PERMITS INTERDISCIPLINARY SYNTHESIS, FUNCTIONAL ANALYSIS AND DISPLAY. The second of these essential capabilities permits the English-language-query/quick response-in-rapid-reference-form iterative procedure which develops the required knowledge of functional relationships between operational and environmental variables. Without this kind of assistance and complete sets of pertinent data, the development of knoledge as to the environmental dependence of the managed system and the quantitative definition of trade-offs between economic, legal, social, operational and environmental factors will continue to be extremely slow and ineffective.

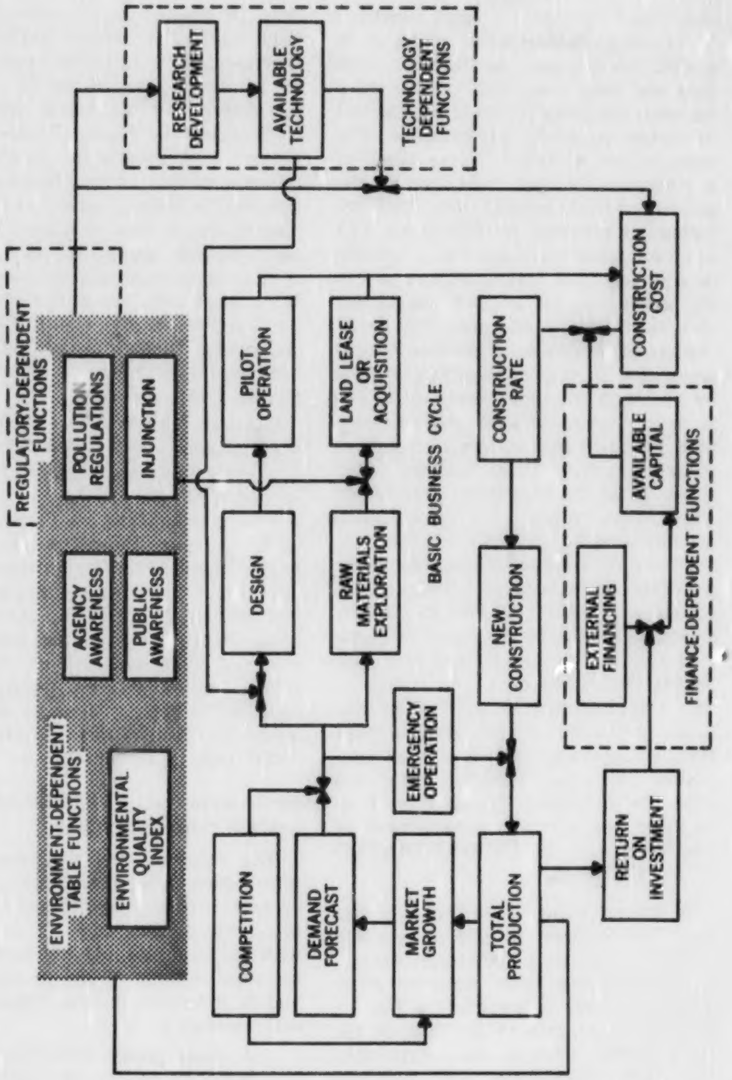
From the point of view of INFORMATION FLOW AUTOMATION, Figure 1 is indicative only of the functional chain. A single query at the top can easily generate 10 to 100 queries at the executive and specialist staff levels and subsequently generate a need for 10,000,000 items of pertinent data. As these data flow back into response channels, the rate of compression must be almost as great as the rate of expansion in the query channel. For example, consider only the types of management questions most often asked today—"What is the environmental impact of construction project A?" and "What is the economic impact of proposed environmental quality regulation B?". Such questions, which are of great importance in today's society, generate huge "impact statements" based on even larger collections of data, opinion, publications, etc.—and even then the statements are largely unsatisfactory because the necessary complete sets of pertinent data are not available and the means to reduce these data to a quantitative definition of economic trade-off for environmental gain or vice versa have not been available.

In further clarification of the SIMULATION function, it is useful to refer to the *highly simplified* diagram in Figure 2 representing a "concept verification test" (CVT) model for an extractive industry. Figure 2 shows a greatly reduced "basic business cycle" and indicates only representative functional inputs from financial, technological, environmental and regulatory controls. In real applications, such models become highly complicated "spaghetti diagrams" wherein all significant functions of the business cycle are represented and cross-connected as required for complete simulation. Also, the financial, environmental, technological, regulatory, etc. cycles are broken down into numerous components interconnected within themselves and to all of the other cycles, again simulating actual management procedures, external controls, internal options, etc.

Figure 2 is presented only to indicate the *nature* of the interaction between environmental factors (the shaded portion of the model) and the managed system. Specifically, environmental factors adjust the transfer rate and time lag between various basic business cycle components while, conversely, the basic business cycle provides outputs which modify the environment in terms of rate of change and time lag. "Environmental quality index" is, of course, a fictitious quantity which, at this point in time, represents a "summation" of various quality indices generally based on the best available definition of allowable concentration of pollutants, best estimates of average rates of exchange, etc.

One point of emphasis regarding the CVT model is that it demonstrates the importance of the "table" or "control" functions generated through both dis-

FIGURE 2.—MODEL FOR AN EXTRACTIVE INDUSTRY


ENVIRONMENT-DEPENDENT TABLE FUNCTIONS
ENVIRONMENTAL QUALITY INDEX
AGENCY AWARENESS
PUBLIC AWARENESS
POLLUTION REGULATIONS
INJUNCTION
REGULATORY-DEPENDENT FUNCTIONS
RESEARCH DEVELOPMENT
AVAILABLE TECHNOLOGY
TECHNOLOGY DEPENDENT FUNCTIONS
COMPETITION
DEMAND FORECAST
MARKET GROWTH
TOTAL PRODUCTION
EMERGENCY OPERATION
DESIGN
PILOT OPERATION
RAW MATERIALS EXPLORATION
LAND LEASE OR ACQUISITION
BASIC BUSINESS CYCLE
NEW CONSTRUCTION
CONSTRUCTION RATE
CONSTRUCTION COST
RETURN ON INVESTMENT
EXTERNAL FINANCING
AVAILABLE CAPITAL
FINANCE-DEPENDENT FUNCTIONS

ciplinary and interdisciplinary synthesis, interpretation and compression of data and information. Such table functions are generated in essentially all organizations, whether their existence as such is formally recognized or not, since they implement the basic business cycle and operate the "valves" which influence rate and time lag which are shown schematically in Figure 2.

In the management process, table functions are generated on the basis of real data which is dynamically correlatable/i.e., data which permit the valid determination of functional relationships. Verification testing of the adequacy and accuracy of table functions in an actual management system or in a CVT model must be based on such data and must involve its use for management purposes followed by analysis of system or model performance. The combination of (1) a "living atlas" of environmental and environment-dependent social process data and information provided by EDMPAS, (2) accurate table functions for a specific or representative organization, and (3) the availability of a CVT model for that organization advances the development of all phases of automation and simulation of the management process by reducing the time required to observe results of strategy and decision and indicating at least the direction of change resulting from trade-off decisions. Even in embryonic and highly approximate form, CVT models can provide a useful guide to accurate synthesis and compression functions in the information management system. Referring to Figure 2, EDMPAS was designed to handle all data and information relevant to the shaded area and permit the development and testing of the relevant "environment-dependent table functions." It can then provide these as inputs to existing models simulating the basic business cycle and other (technological, financial, etc.) interactions pertinent to management or THESE CAN BE INCORPORATED INTO EDMPAS.

A second point of emphasis is that the CVT modeler usually designs the model to receive a "biological index," a "water quality index" on some other quantity which is assumed to have a known relationship to the rest of the CVT model wherein the relationship has been established with sufficient accuracy for model operation. Unfortunately, neither the "index" nor its influence on the basic business cycle is now known. Those functions and real-data-derived table functions represented in the shaded area of Figure 2 are essentially unknown. Environmental properties and processes are *not* adequately described by constants (e.g., climatological averages), periodic functions, or other simple mathematical functions. If "verification testing" is to be an integral part of the CVT model, the output from the shaded area of the CVT model in Figure 2 should consist of table functions generated by dynamic models, or their human equivalent, on the basis of near-real-time data plus historical data (e.g., a "living atlas"). Equally apparent is that environmental properties and processes vary from ecosystem to ecosystem; hence the variable drives (table functions) and related "indices" would differ from one area to another (e.g., from Tampa Bay to Galveston Bay).

General information management systems are already commonly used (e.g., by banks and investment houses) to simulate the *un*shaded functions shown schematically in Figure 2. Detailed ten-year business projections are fully automated by these systems based on a few critical market and operating management forecasts. For those operations which are environment-dependent, however, table functions are not established and verification testing is not possible. In such cases, then, the CVT model is a $100,000 model with million dollar gaps in its structure.

Basic automation/simulation system requirements

The structure and functions of an information flow automation and management process simulation system must obviously parallel and be compatible with the structure and functions of the managed system. From paragraphs A and B, it follows that the "query channel" consists of

—A management level—or *decision* requirement—query which is directed to

—A categorical *knowledge* level consisting of a combination of disciplinary and interdisciplinary expertise where the subqueries essential to response are generated for that information not in hand which are directed to

—An *information* level where data

has been statistically and/or functionally compressed according to a formalized procedure known to be responsive to management needs and, after analysis of the adequacy of on-hand information, directs requests to

—Internal and external sources for those data needed to complete the set from which an informed response can be generated.

The flow of responses in the opposite direction obviously follows the reverse procedure from *data* to organized and statistically correlated *information* to the *knowledge* level where synthesis, interpretation and final compression functions are performed, thence to the management level where compressed knowledge is converted into strategy and *decision*.

Equally obvious, and equally trite, is the fact that all information and knowledge is *not* generated in response to specific management query. Data are generated for many reasons; these are collated and organized into various forms of information as a result of curiosity, or a search for better understanding; knowledge is generated when expertise is directed to the interpretation of such information as a result of general interest or continuing responsibility; and, when apprised of such knowledge, decision and new strategies are *then* formulated.

Automation and simulation of environment-dependent systems must, then, take into account both top-down and bottom-up strategy and decision-making. To stipulate such an apparent requirement risks the accusation of naivete. However, it is a definite basic requirement and does influence information management system design. Further, numerous examples exist where

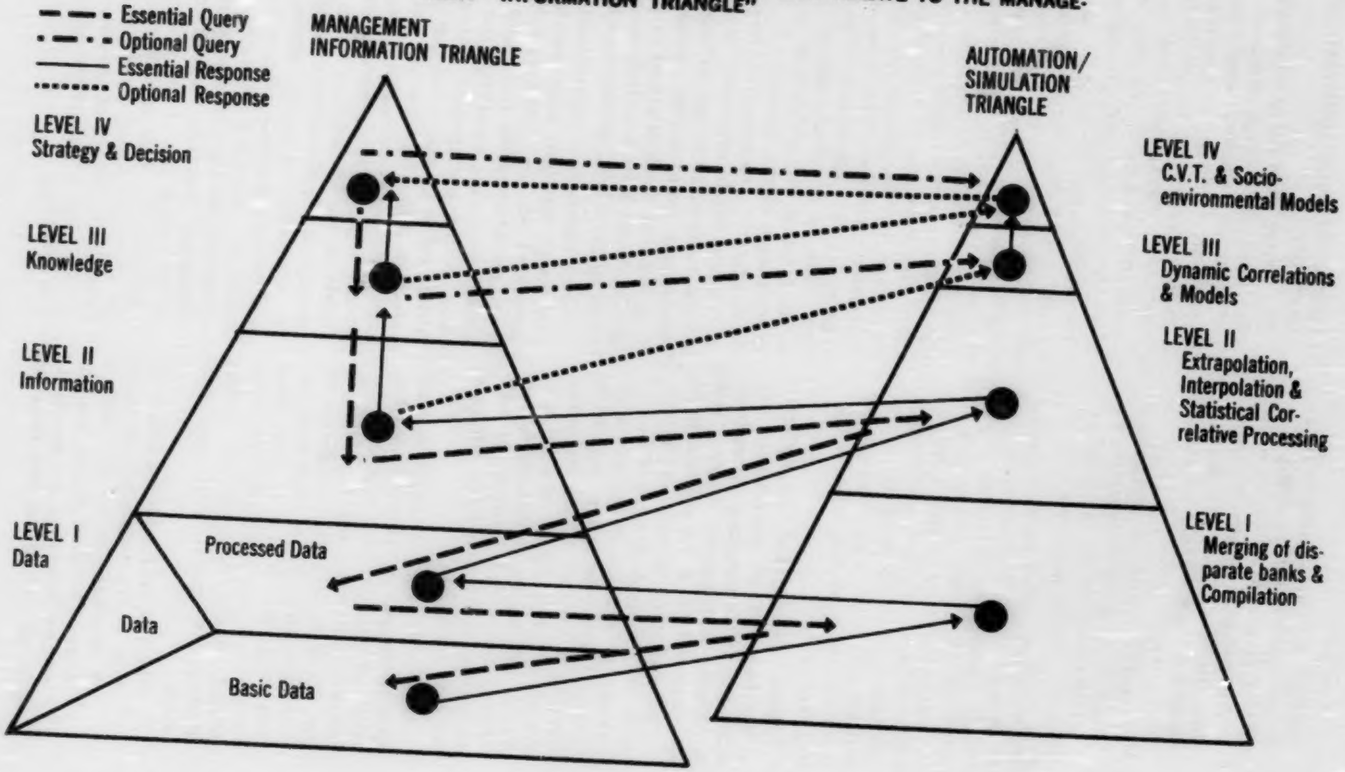
—The top-down designed system results in the acquisition of useless or less-than-effective data and unnecessarily cumbersome and expensive formatting, processing, etc. on the part of the data taker and information system personnel; or conversely,

—The bottom-up designed system all too often provides an abundance of data and statistics which are frequently irrelevant or constitute more data than can be effectively used by management—with attendant increases in the cost of storage, retrieval and processing.

The need to close the feedback loop in such a way that these generally opposing viewpoints are effectively merged is an obvious goal. As stated in paragraphs A and B, the approach taken in EDMPAS development was that of starting in the middle and working in both directions—i.e., developing the system by disciplinary and interdisciplinary specialists who were also engaged in the active acquisition of "live" data, its correlation and analysis in combination with archived data, and interpretation of the composite for the formulation of a recommended strategy or decision. While admittedly "loaded" on the environmental side in terms of development team expertise, considerations such as those described in paragraphs A and B were actively incorporated by the GURC development team.

Good information management system design, therefore, must consider an integrated set of modular software packages whereby the four "levels" of data, information, knowledge and decision in the management system are automated and simulated *to that degree* which is technically feasible and also consistent with management requirements. Figure 3 is a schematic presentation of the interrelation between the management "information triangle" and its equivalent supportive automation/simulation component, Figure 3 is exceedingly simplified. Nonetheless, it categorizes the types of automation and simulation functions required in proceeding either way in the management feedback loop. Also, it is descriptive of the characteristics of generalized functions of the system of integrated software packages required for automation and simulation.

FIGURE 3.—AUTOMATION AND SIMULATION AS THEY RELATE TO THE MANAGEMENT "INFORMATION TRIANGLE"



— — Essential Query
· — · Optional Query
—— Essential Response
······ Optional Response
MANAGEMENT INFORMATION TRIANGLE
AUTOMATION/ SIMULATION TRIANGLE
LEVEL IV Strategy & Decision
LEVEL III Knowledge
LEVEL II Information
LEVEL I Data
Processed Data
Data
Basic Data
LEVEL IV C.V.T. & Socio-environmental Models
LEVEL III Dynamic Correlations & Models
LEVEL II Extrapolation, Interpolation & Statistical Correlative Processing
LEVEL I Merging of disparate banks & Compilation

The triangular shape and progressively smaller area of its segments from bottom to top infer, of course, the progressive conversion from massive quantities of data to highly compressed information. Solid query/response connectors indicate the general situation as it exists in environment-dependent systems—emphasizing, particularly, the *necessity* for automation at Levels I and II and the *optional* nature of simulation and further compression via dynamic correlations and modeling beyond that point.

Recognizing both the optional nature of dynamic and CVT models and the questionable value of general models (i.e., models *not* developed for a specific organization or type of management problem), EDMPAS development has thus far emphasized software to implement Levels I and II. However, the effort has included the development of representative dynamic models of environmental processes and close liaison with the development of CVT models such that their integration into EDMPAS is quite feasible and direct.

Hardware/software incompatability poses technical difficulties to such a general concept. However, the recent breakthroughs in computer technology difficulties such as multi-programming, teleprocessing, teledisplay, mini-computers, distributed intelligence, low cost memories, etc. have set the stage for modular software systems for environmental management to be visualized as a feasible concept rather than technological imagination.

Summary

The EDMPAS environmental information management system is a set of intercompatible software modules selectively integrated by its executive command module, ENVIR. It was developed to permit flexible and efficient management of environmental data and information and to interface with (but not replace) existing archives or banks of data, with dynamic models of environmental and social processes, and with organizational structures and functions (whether computerized or not). Among its established capabilities are:

Handles descriptive botanical, zoological economic, etc. (word type) *data in* the same *alphanumeric* system with physical, chemical, geological and other "hard science" data;

Merges such data from disparate archives, banks, or active data acquisition programs to compile a temporary project information file—and then restores data to the archives automatically via tape transfer or telemetry;

Provides unlimited flexibility as to number and arrangement of *descriptors and items*, and corrections or additions thereto, without system changes;

Extrapolates real data to *any* desired number and distribution of *synthetic data points* (in continuous oceanic and atmospheric processes) as necessary for complete display of dynamic fields as time-series-on-a-map;

Accepts English language interdisciplinary query and responds with graphic or compressed hard copy answers without intermediate handling or manual transfer;

By using *calculated storage and retrieval*, a *complete Boolean* capability, and *complete inversion* of all files, accomplishes these functions at computer speed as a result of *direct access to any bit in storage* and with descriptor and item subset selectability as prescribed by query; and

Since the *compression of data increases geometrically with the number of bits* in the file, it accomplishes these functions with not more than *32K of memory* for essentially *infinite bit accessibility* (and even less memory for useful stand-alone modules within the system) such that utility is not limited to large computers.

These capabilities have been tested using real data from real environmental systems. However, it is in its research applications mode in terms of its state of preparedness for application at this time. Complete integration of the system is not scheduled for completion until approximately mid-1973.

At its fifteen-month stage of development, EDMPAS does not accomplish all of the automation and simulation functions that environmental specialists and their management counterparts might like to have. However, even at this stage, it appears to provide exceptional capability for accession, correlation, compression and display of interdisciplinary environmental information and for the merging and interfacing with archives, dynamic models and existing information systems designed for business or operations management.

VI.6 Integrated regional environmental management project

The Integrated Regional Environmental Management (IREM) Project is a product of the San Diego County Comprehensive Planning Organization (CPO) program to develop and implement a comprehensive regional plan. The IREM project is part of a formulation for a fully integrated and analytically sound comprehensive plan.

The project is based on a regional modeling system to develop accurate and sound information. The planning models are designed to evaluate alternative policies for land use and transportation patterns. Nine steps were defined for establishing a comprehensive plan:

(1) Identify a set of broad long-range regional goals and objectives;

(2)Specify alternative sets of policies and public actions which can be used to achieve these goals;

(3) Develop alternative plans based on policy combinations to represent future development and transportation;

(4) Test each alternative plan concept to determine the effectiveness of alternate policies for achieving goals;

(5) Identify pro and con aspects for each alternative plan;

(6) Evaluate each alternative plan for effectiveness, feasibility and cost;

(7) Select alternative plans and policies;

(8) Decide upon an implementation plan that utilizes public facilities and services; and

(9) Monitor actual growth and development and relate to goals.

IREM relies heavily on five computer models. Each model examines a different aspect of a regional environment. The elements of the regional models system may be used independently for analyzing a specific problem for which it is best suited, or may be used in sequence, with the output of one sub-model serving as the input of another. Figure 1 shows the individual models and their linkages.

Interactive population/employment forecasting model

The Interactive Population/Employment Forecasting (IPEF) model is designed for long range forecasts of population and employment, given various regional policies. For example, regional population and the quality of growth could be substantially affected if there were a regional growth policy.

The model responds to alternative policies and tests their effects and impact on unemployment rates, family planning, health care, industrial expansion and population migrations.

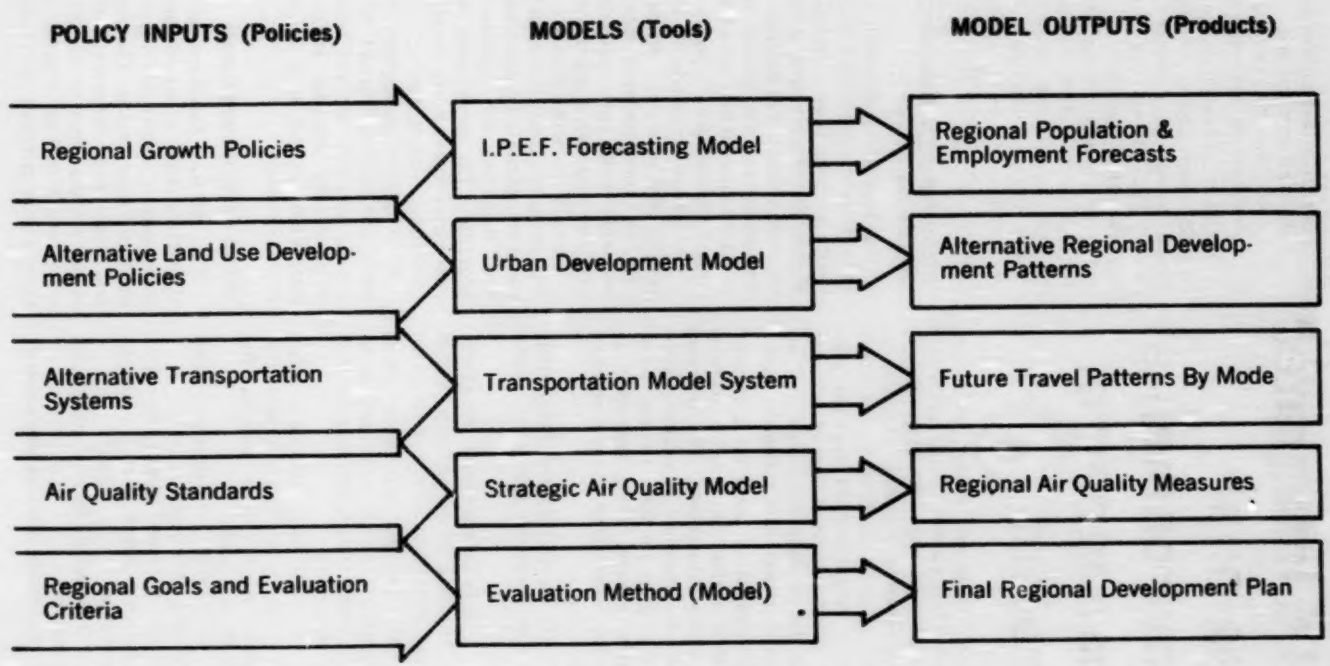
The IPEF model has five regional growth components: births; deaths; employment-related migration; military-related migration; and retirement-related migration. The components have various mixes that are simulated for specific policy alternatives.

Each policy assumption which is used, produces a forecast of population by age, race, sex and industry employment for five-year intervals. The generalized output may be in graph or tabular form.

Urban development model

The Urban Development Model (UDM) is itself a set of sub-models that simulate development patterns in the San Diego region. The population and employment forecasts of the IPEF model are the input to the Urban Development Model for regional distributions. Given growth policies and devel-

FIGURE 1.—REGIONAL MODEL SYSTEM


POLICY INPUTS (Policies)
MODELS (Tools)
MODEL OUTPUTS (Products)
Regional Growth Policies
I.P.E.F. Forecasting Model
Regional Population & Employment Forecasts
Alternative Land Use Development Policies
Urban Development Model
Alternative Regional Development Patterns
Alternative Transportation Systems
Transportation Model System
Future Travel Patterns By Mode
Air Quality Standards
Strategic Air Quality Model
Regional Air Quality Measures
Regional Goals and Evaluation Criteria
Evaluation Method (Model)
Final Regional Development Plan

opment constraints, the UDM distributes future incremental growth and identifies the growth pattern for subareas within the region.

The model uses an "allocation function" to examine potential development within the region. The three basic factors used are: (1) The accessibility to employment opportunities, examining commuting patterns and travel times; (2) the availability of developable land, considering residential densities and open space policies to locate this developable land; and (3) the "attractiveness" of a given area, based on characteristics which would attract developers (housing values are used as the measurement for "attractiveness").

The alternative policies of transportation systems, governmental services and land use are used as input for the allocation function. Transportation factors considered are those which affect travel times, costs and alternative modes of transport. The urban governmental factors considered are muncipal water and sewer services. The identification of land specifically withheld from development is based upon land constraints, which were established for topological or planning considerations.

Each of the policies (transportation, governmental services, and land use) works independently and in concert with the others to determine development that will occur in the region. Primary regional factors such as income, family size, housing needs, recreation, industry employment, government goods and services and transportation needs are all interrelated to establish the final development growth patterns.

The Urban Development Model provides output on how the region would develop under various policy alternatives. The model forecasts an economic and land use profile for a variety of geographic units. Details on total population and dwelling units, employment by place of work and place of residence, total land use acreage by type of use, household income, housing values and property, sales, and income tax revenues are available by census tract (315), regional traffic zones (85) or the smallest geographic unit, traffic zones (663).

Transportation model system

Using detailed descriptions of a transportation system (speeds, distances, costs and travel times) this model simulates traffic patterns for different segments of a transportation network. The overall transportation model system consists of four individual sub-models: trip generator; trip distribution; mode split; and assignment.

The trip generator model estimates the origin and final destination of trips according to traffic zones. The model considers the numbers and locations of residences and places of employment. Identification of the transportation mode (automobile, bus, train) is performed by the mode split model. Identification is made of the type of trip including purpose, basic transportation characteristics, costs, time, and convenience, and of the user characteristics, such as income, age and occupation.

The final element of the network, to identify the route for each trip, is accomplished by use of the trip assignment model. Assignments are made on the basis of minimizing time and distance to a trip's destination.

Output from the transportation system model indicates the future patterns for transportation facilities. By indicating traffic densities and user facilities, it facilitates making policy decisions on existing and proposed facilities.

Strategic air quality model

The Strategic Air Quality (SAQ) model describes future air quality based on fixed and mobile pollution sources, as well as meteorological characteristics. The Urban Development Model and the transportation model provide the input on the sources (fixed and mobile) to the Strategic Air Quality model. Once located, the dispersion of these pollutants throughout the region is examined by the Strategic Air Quality model, which then provides the expected regional pollutant levels.

The plan evaluation method (or model)

The final step of IREM is the Plan Evaluation Method. The previously discussed models provide details on population, housing, employment, land use, transportation and environmental quality. Using the output of all the models the Plan Evaluation Method related the data to predetermined criteria in order to identify those policies that produce the most desired situation and meet the plans for the San Diego Region.

Conclusion

The models explained above require a large computer system for their maintenance. Since the IREM model was designed for a specific region, another area would have to establish a data base before it would be able to adapt the model for its own usage.

The project has limitations that are not exclusive to IREM. The models require gross assumptions and accurate, reliable and current data. City, county and industry interests must work together. However, the model does integrate environmental considerations into the policy making process, is highly flexible to meet the region's needs, and is technically sound.

VI.7 General environmental model*

The General Environmental Model (GEM) is still in the development stage. When completed, it will provide policy analysis and strategies for responding to urban problems and issues for use by policy and decision makers. (GEM is to be an Urban Policy Model.)

Basically, the GEM provides information for urban-environmental policy evaluations. Using specific policy criteria as input, spatial and temporal distributions are the output. The model includes various physical, economic and social indicators and uses interrelationships to provide secondary and tertiary effects.

One of the more important aspects of the GEM is the quality of urban life indices. Indices are provided for pollution, housing quality and costs, quality of public services, and public preferences for goods and services. Presented as levels of dissatisfaction, the indices induce change and allow for more complete interrelationships to occur.

The GEM, when completed, will consist of various subsections to meet the needs of a variety of users. Unlike many models, the GEM is not being designed for or by a specific municipality, which would require various modifications if the model were to be used by other cities. Rather, it is to be a general policy model, designed for a specific task, which can be used by anyone.

Data bases

The GEM requires an extensive data base that, like most, requires a great amount of time and expense to construct. The model's data input will have three basic characteristics. First, they will be displayed spatially on a grid with 625 squares, each square representing one square mile. However, the grid may be clustered into jurisdictions with input correlated to jurisdictional boundaries. Second, the data input will provide description of natural, physical, human, and monetary resources. Third, the data will be adapted to fit the system behavior of economic, social and government sectors.

The general data categories include: topographic and geographic, land use and zoning, transportation network, housing and population density, levels of public and private sector activities, and monetary conditions.

To save time and expense for a user of the model, representative situations are under development. To test the impact of a policy decision there will be nine model data bases representing 221 Standard Metropolitan Statistical Areas (SMSA) known as Modal Cities.

As an alternative, there is a data base generator, known as the Simulation City model, under development.

Modal cities

The modal cities provide GEM users with a standard urban area's data base. There are nine basic types of modal cities defined for use. Type A consists of very large, highly-developed urban areas with important manufacturing sectors. Type B is highly specialized in recreation, with rapid growth and high income. Type C contains the medium-sized areas with a relatively smaller service sector, emphasizing distribution and some manufacturing. Type D areas are affluent and growing, but less highly urbanized. Type E represents less well-to-do areas with elderly populations. Type F are traditional New England with relative stagnation, lack of wholesaling and an absence of Blacks. Type G are nonmanufacturing with rather high levels of poverty and many

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* The General Environmental Model is being developed under the auspices of the Environmental Studies Division, Washington Environmental Research Center, Office of Research and Development, of the U.S. Environmental Protection Agency.

Blacks. The Type H areas are archetypal Midwestern, stressing manufacturing, somewhat smaller but growing. Finally, the I group are reasonably affluent, medium-size regional centers, individually specializing in a variety of functions. Representative areas for the nine classes are shown in Figure 1.

Simulation city

The Simulation City (SC) model will assist the GEM users in preparing a regional data base. The model will utilize descriptors for a specific SMSA to generate a detailed data base to meet the requirements of GEM.

Required inputs to the SC model are metropolitan area descriptors, either explicit (e.g., population) or subjective (judgments), and topology descriptors (roads, rivers, non-developable land). These inputs provide limitations for the ongoing simulation.

The actual simulations provide a data base by using location and economic theory. For example, industries are located near transportation sources, and distances are minimized for households and services. While detailed area information can be used to generate the data base, the SC model is designed to use readily available information (from the statistical abstracts and United States Geological Survey (USGS) topographic maps).

Decision inputs

The GEM will have decision simulators for economic, social and governmental sectors. Presently only the Economic Decision Simulator (EDS) is under development. The simulators utilize decision trees to assign probabilities to specific courses of action based on past success of those actions.

The GEM user can plan actions for economic activities with information provided on economic patterns. The simulator examines the economic sector with respect to new business formation, land use allocation, economic growth, business operating decisions, business expansions, and provides input to the social and government sectors. The decision simulators will limit the number of inputs required by the GEM user.

The simulators are an independent sub-model of the GEM and therefore allow the user to modify or substitute decisions before final processing. The decisions available to the GEM user are shown in Figure 2.

GEM modules

After the data has been established and the decision inputs made, the final processing through the GEM can be accomplished. Four GEM modules provide a basic system framework and user evalauation of goals and needs.

The Social Module contains population groups broken into socio-economic classes, population characteristics and population needs (housing quality, school quality).

The Economic Module presents basic economic activities (industries and services) describes economic needs, business transactions, growth, and economic and environmental effects.

The Government Module describes the public and semi-private activities that serve basic governmental services. These include: budgets, tax rates, assessments, zoning, public safety and

FIGURE 1.—*Modal Cities Suggestions*

Type A
    Philadelphia
    Cleveland
Type B
    Las Vegas
    Reno
Type C
    Kansas City
    Dallas
Type D
    Phoenix
    Orlando
Type E
    Knoxville
    Ashville
Type F
    Lowell
    Worcester
Type G
    Mobile
    Savannah
Type H
    Saginaw
    Rockford
Type I
    Tulsa
    Tacoma

FIGURE 2.—*Decisions Available to Users of the Model*

1. Economic Decisions
    - buy and sell land
    - set rents
    - set prices
    - set salaries
    - set maintenance levels
    - lend money
    - borrow money
    - build and demolish three types of residences, twelve types of basic industries, and four types of commercial establishments
    - transfer money to other economic and social and government decision makers
    - boycott commercial establishments
    - construct chlorination, primary, secondary and tertiary effluent treatment facilities at basic industries
    - change the operating level of a business (without demolishing the building)
    - set the amount of water which is recycled at basic industries
    - construct residences which use ground water
    - set the fuel mixture for an economic activity
    - contract between a basic industry and a solid waste company for solid waste collection
    - convert an industrial open dump into usable land
    - install and remove three types of air treatment at a basic industry
2. Social Decisions
    - allocate time to extra work, education, politics and recreation
    - boycott work locations, commercial establishments, and modes of travel
    - set the dollar value of time traveling to work
    - transfer money to other social, economic and government decision makers
3. Government Decisions
    - grant appropriations
    - grant subsidies
    - transfer money to other government and social and economic decision makers
    - set welfare payments
    - set tax rates
    - float bonds
    - assess land and buildings
    - buy and sell land
    - set the number of job openings in government
    - set government service districts
    - request Federal-State aid
    - set the salaries offered government workers
    - build and demolish schools
    - build and demolish municipal service plants
    - grant contracts with local goods and service establishments for government purchases
    - set the amount of public adult education offered by the government
    - construct and demolish roads
    - construct and demolish terminals
    - zone land
    - build and demolish public institutional land uses
    - provide parkland
    - install water and sewage lines
    - construct and demolish water and sewage plants
    - locate bus routes
    - buy and sell rail rolling stock
    - locate rapid rail routes
    - set the amount of service on bus and rail routes
    - set the maintenance level of government facilities
    - set prices for private use of publicly-provided water
    - construct and demolish primary, secondary, and tertiary sewage treatment plants
    - construct and demolish water intake treatment plants
    - locate municipal water intake points
    - locate municipal sewage outflow points
    - locate water sampling stations
    - change a business' operation level (without demolishing the building)
    - build and demolish nuclear and fossil fuel power plants
    - set fuel mixtures at fossil fuel power plants
    - set fuel mixtures at schools
    - set fuel mixtures at municipal services
    - build and demolish cooling towers at power plants
    - install and remove air treatment at fossil fuel power plants
    - set power prices
    - create land fills
    - convert land fills into usable land
    - contract between a basic industry and a Solid Waste Company for solid waste collection

- contract between a Solid Waste Company in one jurisdiction and that in another jurisdiction for use of the other's land fill site
- set solid waste collection fees
- build and demolish incinerators
- install air treatment at incinerators
- assign parcels to incinerator districts
- establish ambient air sampling stations
- establish point source air sampling stations
- set air and water pollution fines
- set air point source regulations
- buy and sell buses
- set bus and rail fares
- build rail lines
- build rail stations
- assign parcels to land fill districts
- raise local air ambient standards above national standards
- implement motor vehicle pollution emissions regulations

welfare services, utilities, education and transportation.

The Environmental Module represents fuel, power and water consumption; the generation of consumption and industrial processes pollution; and pollution treatment activities. Also included are secondary pollution effects.

Operations

The last stage of the GEM determines the system behavior through the interrelationships of allocated resources via the GEM modules and the effects of the decision inputs.

There are eight operations in the final calculations: population shifts are determined through dissatisfaction indices; developments are depreciated with calculations made for maintenance expenditures; full and part-time workers are assigned jobs by ranking their education achievements and maximizing their net salaries; total transportation costs are minimized subject to public transit capacity, road congestion, and transportation boycott constraints; school quality and capacity are used to allocate students by districts; each population unit is allocated time for education, politics, recreation and employment; personal goods and services and business goods and services expenditures are allocated by minimizing total costs; and final calculations are made for indicators, incomes and expenditures.

Output

There are four output modes to the GEM: maps, indices, detailed information, and summary information. The map output provides visualization of economic activity, transportation networks, municipal services, land use, planning and zoning, and market values. Information is provided for each of 625 grids in a detailed format of economic and demographic uses.

Indications about quality levels are provided by indices. Indices are provided for: pollution (air and water quality); neighborhoods (housing, rents, schools, tax rates, and services); health (crowding, bacteria counts and services); and time (involuntary, transportation and recreation).

Detailed information is available to examine the exact functional relationships of the model. Economic activity, pollution levels, financial operations, and employment selection can be developed in detail.

Summary information is provided by descriptions and graphs for every major economic, environmental, social, and governmental activity processed by the GEM.

Conclusions

The GEM will provide a user one-year cycles to determine the present status of an urban area's resources and policy effects on those resources. The model can, through iterations, examine urban area effects brought on by various policy changes. The model is basically concerned with the allocation and reallocation of systems resources given the effects of various policies and their implementation.

The model is an attempt to provide

policy and decision makers the capability of analyzing urban-environmental issues. Using a systems simulation, policies can be examined in detail as to their effects, and workable solutions and alternatives may be suggested.

VI.8 The strategic environmental assessment system (SEAS)

Dr. Stanley M. Greenfield *

I am pleased to discuss with you this morning a research project underway in my office to develop a Strategic Environmental Assessment System, known as SEAS. This project is particularly appropriate in the context of this conference and especially within the scope of this session on Environmental Technology. As you will see, the SEAS project is based upon the fundamental premise that modern computer technology, when combined with expert opinion, can if applied properly be of significant value in assisting public decision makers at all levels of government in understanding the complex inter-relationships of the environment and the less apparent consequences of our current and contemplated policies and actions.

The EPA is charged to carry out a program that will result in the protection of the environment of the nation by abating or avoiding pollution. Currently, this program is primarily regulatory in form. In response to this charge, the program of my office is structured so as to emphasize the accomplishment of the following six major goals:

(1) The development of appropriate science and technology for setting and enforcing pollution control standards;

(2) The full understanding of the environmental impact of that which we are mandated to control;

(3) The knowledge of what it "costs" to meet environmental quality standards;

(4) Knowledge of the "costs" of not meeting environmental standards (i.e., the benefits to be derived from meeting them);

(5) Monitoring, to meet environmental goals; and

(6) Establishing the means to forecast the long-range effects of societal actions so as to avoid deleterious environmental impacts.

The SEAS project is primarily focused on this last goal and is primarily concerned with developing an improved capability to strategically assess the comprehensive and long-range environmental effects of various policies upon society.

It is clearly recognized that the acquisition of such a capability involves a number of very difficult obstacles. In this connection it is instructive to consider a number of the more apparent problems that beset any such endeavor.

First, there is the critical issue of *uncertainty*. No one factor exemplifies this issue more than the attempt to predict future technological trends. Technological trends are perhaps the most critical component of any forecast of the future, but also the most difficult to assess. The institutionalization of R&D efforts has, to some extent, alleviated the problem of anticipating new technologies, but the nature and timing of technological "breakthroughs" and, more importantly, the rate of implementation, remain subject to many unpredictable factors. One thing we have learned is that there is wide variation in the rate of adoption of new technologies.

A corollary issue with respect to technological forecasting is predicting impacts upon society. We know from experience that institutional and social factors and values are fundamental to environmental quality, yet our ability to predict such changes is equally difficult. For example, assessing the first-level impact of new technologies upon the economy is problematical in itself: but predicting the secondary effects of technology on human life styles, urban form, and behavioral patterns and values is extremely complex.

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* Presented by Dr. Stanley M. Greenfield, EPA Assistant Administrator for Research and Development at the National Conference on Managing the Environment.

Secondly, we face the issue of the *interrelationships* of factors and the nature and degree of interaction. It is obviously not sufficient to state that environmental factors are related to each other. What is important is to acquire better knowledge on the "why" and "how" of these relationships. Central to this problem of interaction is the nature of the driving force and the resulting perceived environmental system. As we all know, the status of the environment depends upon a complex series of actions and inactions at all levels of government, industry, natural processes, and human behavior, to name but a few. Such actions occur in a highly decentralized fashion. Those of you with responsibility for environmental management know well what your sphere of influence involves—whether it be geographical, jurisdictional, legislative or economic. Thus, from the perspective of prediction or forecasting, major problems are faced in terms of measuring both the nature of these decentralized actions and, perhaps more importantly, their interrelationships.

All forecasting starts from the premise that there are certain continuities running through the past and present into the future, and that the reactive or response type of decisions can be assumed to have relative relationships. In predicting environmental consequences of policy choices, the assumption that a first order forecast is a simple extrapolation may be inadequate, because the complexities and subtleties of the interactions are simply not well understood, and the multitude of unforeseen branchpoints downstream preclude this type of approach.

Another difficulty in forecasting involves the risk of *deceptiveness of short-term considerations*. On the one hand, such a risk justifies the need for long-term forecasting, since assumptions made about the nearterm future are often spurious with respect to the longer-run ramifications, which may be irrevocable. In practice, however, the complexities to be dealt with in forecasting are normally assumed to be of one form or another based upon our best estimates of the future, which usually amount to short-term considerations. Thus we have a double-edged sword—we are continually faced with the need for long-term forecasting but constrained by near-term comprehension and understanding, coupled with the demand for near-term decisions.

Furthermore, we must consider the issue of *validation*. Assessment of the implications of policy choices is critical to effectiveness, and the quality of our techniques for conducting such assessments is fundamental to the process. There is much information in the literature describing the problems and needs of validation, but the state-of-the-art is imperfect. Essentially, one must be continuously conscious of the issue and strive to improve the methodology as experience is gained. Effective forecasting of the past to the presnt is a minimum test of validation, but by no means sufficient, primarily because our models, drawing from past experience, are expected to optimize such forecasts.

In summary, there are difficult and complicated problems involved in forecasting. These must all be taken into account and internalized as one attempts to develop a capability for strategic assessment.

On the positive side, however, there are numerous significant benefits to be gained from attempting to forecast future problems. From a policymaking point of view, the ability to consider the likely long-range and comprehensive implications of policy choices can contribute substantially to policy effectiveness.

First, one can have the benefit of organization of thought. Strategic assessment requires structuring choices, considering ramifications and attempts at predicting impacts, all of which demands some set of rational criteria by which policy choices can be evaluated. The concept of "alternative futures", or the consideration and evaluation of alternative states of the environment, is one such example. With an effective forecasting capability, one can develop certain scenarios within the general limits of expected growth trends or patterns and evaluate the likely outcomes or impacts upon environmental quality. Only by organizing and bounding the possible futures can one rationally consider alternatives for growth policies.

Another benefit is the ability to help move environmental policies in the direction of protection. With an ability to foresee long-range pollution problems, in an "early-warning" sense, one can consider corrective actions in the interim to protect rather than only to regulate or penalize. Thus new policy options are surfaced which may have been overlooked. Policies in the areas of incentives, land use planning, risk avoidance, and conservation, for example, may be shown to be of greater long-range value or, alternatively, shown to be of little overall consequence, if not counter-productive in certain respects.

Effective strategic assessment can also assist environmental managers in decision making. As some of the speakers at this conference are pointing out, we can no longer assume that the natural abilities of the market place and our behavioral patterns will self-correct, or, in other words, automatically turn the environment around toward quality. Rational consideration of various management strategies and actions is necessary before problems result from poor or nonexistent planning. In particular, our technological and institutional solutions need to be broadened to include the long-range effects of our actions or inactions. In this context, forecasting within a comprehensive framework can assist the management of policy making.

One example of this concept is the ability to use forecasting as a means to track progress in reaching goals. For instance, a growth policy may be established which is designed to reach a long-range goal of a specified quality of life. Forecasting techniques can then be applied periodically to assess the actual progress being made over time toward achievement of the goal. In this way, mid-course corrections can be made in the policy or, if necessary, in the goal statement.

In a similar fashion, one can measure the impact of alternative policies. For example, a set of alternative growth policies could be tested at that point in time and evaluated according to their relative impacts upon the environment and thus their projected progress toward reaching the stated goal. In this way, the forecasting system would be sensitive to perturbations in that progress, for example, unforeseen value changes, and would highlight those areas in need of modification.

It is clear that one does not have to produce a perfect forecast system in order to obtain many of the above benefits. Let me now highlight a few of the characteristics of SEAS which is being designed in general to acquire the previously mentioned benefits.

First and foremost, SEAS is a research project. As such, it is time-phased in its development cycle. The research plan revolves around our ability to synthesize the available state of the art in techniques and methods for assessing long-range comprehensive pollution problems.

SEAS has a number of attributes, the collection of which differentiate it from other models and systems which have been attempted in the past. Some of these are as follows:

(1) SEAS will deal explicitly with pollution generators and possible controls and known effects of residuals;

(2) It is to be a national-level model system for use by EPA Headquarters and Regional policy makers;

(3) It is to have a ten to twenty year time horizon;

(4) It will make use of "official" environmental, economic and demographic data;

(5) It is to be used together with expert opinion to maximize the combined man-machine capabilities; and

(6) SEAS will project the state of the environment and socio-economic systems in the ten to twenty year planning period that would likely result from alternate projects of population growth, technological change and economic activity levels, and the effects of environmental policies in a comprehensive context.

Thus, SEAS is to be a complex model system, attempting to tie together in a comprehensive sense the interrelated areas of environmental and socio-economic factors.

At this workshop, you will be able to learn about the progress made over the past six months on the SEAS Test Model. This test model is being done as a research tool for the development of the SEAS Prototype Model that will be completed by December and used to prepare a "1980 State of the Environment" projection. The prototype will be a state-of-the-art system insofar as it will incorporate the best available submodels into the comprehensive SEAS context. We are now in the process of surveying various federal and state/local agencies, research institutes, universities, and private firms for the most appropriate set of techniques and data bases for the SEAS Prototype. One of the final products of the SEAS prototype effort will be complete documentation of the effort and an estimate of what benefits and costs would be incurred from proceeding further toward the full SEAS system.

Let me now mention briefly some ideas we have for the application of SEAS when it is developed.

Initially we envision SEAS aiding in the assessment of alternative policies in terms of their long-range impact on the environment. This use we view as a "process," whereby SEAS, as a computer-based system of models, will be augmented by human expert opinion in an integrated analytical fashion. State of the Environment Reports can be produced, which result from man-machine analysis of the long-range ramifications of current and contemplated environmental policies upon the Nation and Standard Federal Regions.

This initial use could also involve assisting us in the illumination of possible research goals and needs. If it is possible to describe the environmental system, it may then follow that sensitivity tests may help in identifying potential gaps in the sense that our information in certain areas may be lacking and the particular gap may be more important than we thought. Our goal of a better understanding of the way the total environment interacts with itself, with man, and with all the elements that go to make it up, may be broken down, with the help of SEAS, into relative critical components with varying research needs.

Ultimately SEAS could be helpful in formulating policy choices and in monitoring the overall progress of the Nation or region in reaching policy goals. Obviously this will require effective solutions to the forecasting issues I mentioned earlier. But we are hopeful that development of the Prototype will indicate that it can be done, because this is the most effective way we can hope to anticipate long-range problems and to take proper actions to prevent them from occurring. For instance, we know from experience that the problems we face today are not necessarily those we will face at some time in the future. This is the principal reason that technology alone rarely solves problems. Institutional and societal factors and values really determine the success of proposed solutions. With an effective forecasting system such as SEAS we may have the capability to consider new policy options and assess their ramifications upon the total environment.

Finally, I want to suggest to you that the concept and process underlying SEAS is directly applicable to your organizations and objectives. As you move toward a more comprehensive and integrated view of managing the environment, the process of organizing and synthesizing the best available information to consider alternative policies can be extremely beneficial as a management tool.

We believe SEAS is a very worthwhile research project. It is being developed carefully and documented completely and I encourage you to follow its progress and take advantage of our experiences. Since we have the same environmental management goals, our techniques and methodologies should be shared.

VII: Intergovernmental Relations in the Environment

Environmental management has traditionally been a local responsibility. Environmental functions such as sewage, solid waste disposal, and water supply were among the earliest performed by local governments in the United States. Throughout the twentieth century, however, there has been increasing environmental activity at the state and federal levels, and the relationships between the federal, state and local levels have changed.

As might be expected, the changes in the roles and responsibilities among levels of government have resulted in conflict and uncertainty. Not only is there some turmoil surrounding the roles of the three basic levels of government, but efforts to solve environmental problems have led to the development of regional approaches, e.g., regional sewer districts.

The result has been confusion and frustration for all concerned. Local governments, for example, often feel trapped between changing environmental standards, increasing enforcement actions, expanding investment in environmental facilities, and continuing uncertainty of state and federal financial assistance. Speaking at the Conference, John Quarles, Deputy Administrator of EPA, explained:

> "One of the themes that has come out repeatedly is a concern that the problems have to be solved at the local level. There has been . . . frequent comment by city administrators to the effect that the state officials do not understand the problems that exist at the city (or county) level, the need to deal with the problems there, and the need for flexibility to deal with them in a way that makes the most sense in light of the local circumstances. The state representatives say that the federal government does not understand the need for flexibility to deal with these problems at the local (state) level. Our regional people say that the Headquarters in Washington does not understand the need for the regions to have flexibility. Then I say . . . to you . . . that I guess we do not understand."

As the most powerful actor in the intergovernmental arena, the federal government has developed a clear policy direction—"New Federalism," to help bring order to the system. The complex web of intergovernmental relationships in the area of environmental management promises to serve as a fundamental test of that policy.

NEW FEDERALISM

The concepts behind the "New Federalism" had antecedents during the 1960's, when attempts were made to emphasize decision-making at the state and local levels. As discussed today, the objectives of the New Federalism include: (1) redistribution of revenues and power from the federal government to the states and local governments; and (2) reorganization of the federal bureaucracy to make it more responsive and more regional. President Nixon stated in his 1971 State of the Union message:

> "The idea that a bureaucratic elite in Washington knows best what is best for people everywhere and that you cannot trust local government is really a contention that you cannot trust people to govern themselves."

At the present time, the major elements of President Nixon's "New Federalism" include:

—general revenue sharing, a program returning $30.2 billion to state and local governments over a five year period for expenditure in nine broad areas;

—special revenue sharing, a proposal combining a number of categorical grant programs into funds for broad general purposes—community development, education, manpower, etc.

—federal regional councils, the focusing of federal efforts and authority at the regional level to handle specific problems as close to the source as possible given to the councils representing seven federal agencies in each of the ten federal regions;

—intergovernmental cooperation, particularly the A-95 review process which allows state, regional, and local review of certain federal or federally assisted projects;

—administrative changes, including reorganization of the federal bureaucracy along program lines, decentralizing federal operations, establishing uniform regional boundaries, reducing grant processing time, and simplifying regulations.

Many of these programs are currently being implemented. Proposals for special revenue sharing and federal reorganization have not yet been approved by the Congress.

THE FEDERAL ROLE IN ENVIRONMENTAL PROTECTION

Federal involvement in environmental management expanded rapidly after World War II. This involvement has generally moved through three stages. The tendency has been for Congress first to enact legislation encouraging state and local actions and establishing a federal agency for monitoring research and technical assistance. This is followed by legislation containing greater incentives to state and local governments, plus federal authority to promulgate certain standards. Finally, Congress has mandated action at the state and local level, backed by the authority of the federal government to implement programs where necessary. For example, in 1955 Congress authorized the Public Health Service to provide air pollution research and technical assistance. The Clean Air Act of 1963 contained financial incentives for state and local programs and limited federal enforcement to seek relief during interstate air emergencies. The Clean Air Act of 1970 authorized national standards to be established (and enforced if necessary) by the federal government. The same progression can be cited in the area of water pollution, beginning with the Water Pollution Control Act in 1956. The federal role was gradually strengthened by the amendments passed in 1961, 1965, and 1972. Another example of the expanded federal environmental role is the National Environmental Policy Act, passed in 1969, which requires that federal and federally-assisted projects be evaluated for their impact on the environment.

These examples seem to substantiate the position that environmental management, pollution control, in particular, is being concentrated at the federal level. This would seem to be a contradiction of the "New Federalism." In clarifying this point, EPA Deputy Administrator Quarles agreed that:

> "There has been a tendency for Congress to pass laws which specify that there be a stronger role. . . . [While] it is true that these problems do need to be handled at the local level, it is also true that the legislation which has passed sets a number of obligations which must be monitored or met by EPA or other federal agencies. These are responsibilities in setting standards, in specifying what the best pattern of controlled technology means for industry, in developing systems for planning programs, and in setting out the framework for a variety of actvities to occur."

In response to the policy direction of the New Federalism, the Environmental Protection Agency formed regional offices conforming to the uniform regional boundaries. Regional Administrators were given a broad mandate for administering the Agency's programs in the field. The EPA Regional Administrator for Region I, based in Boston, John McGlennon, commented that:

> "There is an old adage that applies here. You can declare war in Washington, but you have got to run the war in the field. This seems to me to summarize the basic domestic policy thrust of the Environmental Protection Agency and, in fact, of the Nixon Administration. It is a program of decentralizing federal bureaucratic power and on increasing state and local authority. This is the essence of the New Federalism. . . . In order to administer these laws, to manage pollution control, . . . EPA must recognize two facts: [1] the states will be doing much of the day-to-day work, and [2] it is the regions that must have the authority to assist them."

Recent federal environmental legislation, notably the Clean Air Act of 1970 and the 1972 Water Pollution Control Act Amendments, has resulted in two major changes in roles and responsibilities in the federal system: (1) increased federal authority over state and local jurisdictions; and (2) increased responsibility regarding environmental matters for state and local jurisdictions. In each case state governments are given primary responsibility for implementing the legislation. States are to prepare plans for implementation of both air and water programs. This has led both state and local governments to extend their authority into areas generally bypassed before. For example, state and local governments must have authority to act in case of an air pollution alert.

On the other hand, EPA defines the program to be implemented, approves the state plans, and retains authority to intervene when not satisfied with state and local performance. A recent example of this was the issuance, on July 6, 1973, of transportation control measures by EPA to achieve air quality standards in eleven metropolitan areas (Salt Lake City, Utah; Seattle and Spokane, Washington; Chicago, Illinois; Phoenix-Tucson, Arizona; Fairbanks, Alaska; and the California urban areas of San Francisco, San Diego, Sacramento, San Joaquin Valley, and Indio). These controls were issued to supplement sections of state plans that were found to be inadequate. The measures included: automobile inspection and maintenance, automobile emission control requirements, parking limitations, and gasoline sales restrictions.

THE STATE ROLE

States were relatively inactive in the environmental area until around the turn of the century, when programs in the areas of health and conservation were widely adopted. State activities increased with federal encouragement after World War II, developing stronger programs in air and water pollution control. The recent environmental movement has had tremendous impact on state programs. Since 1970, nearly every state has passed legislation to preserve environmental quality, and several have made major organizational changes (see Chapter III). The range of these new programs include: land-use planning, growth controls, wetlands protection, coastal zoning, environmental facility financing, environmental impact assessment, surcharge on non-returnable containers, restrictions on chemicals (e.g., phosphate) and pesticides, as well as increased efforts in air and water pollution control, and solid waste disposal.

In many ways, the state holds the pivotal position in terms of determining the shape of intergovernmental relations in the environmental field. In addition to defining their own environmental role, their action or inaction in response to recent federal legislation, such as air and water programs, determines whether the federal government will become directly involved in implementing various environmental programs or whether the state will retain primarily operational responsibility. Also, by virtue of the legal dependence of local governments on states, states dictate the role and functions of both regional and local governments. In an article found later in this chapter, "State Responsibility in Managing the Environment," Dan Lufkin, Commissioner, Connecticut Department of Environmental Protection, discusses the need for states to assume the initiative in developing environmental programs and to be charged with implementing major federal programs.

Recent federal legislation in the areas of air pollution control, water-pollution control, and land-use planning have emphasized implementation at the state level. In the area of water pollution for example, states are given the responsibility for such activities as setting standards (as long as minimum federal standards are met), administering the permit program, developing state water plans, placing priorities on construction needs within the state, and designating areawide planning and management agencies. In each of these areas, state actions must be approved by EPA. Failure on the part of the states to follow through, however, will result in federal assumption of these new programs.

States also are a major influence on the form of regional and local jurisdictions. For instance, a state may allow regional planning commissions, councils of governments, special districts for certain functions, but not multi-purpose districts. The legal framework for those jurisdictions are set by state law. This framework can include such factors as: area of jurisdiction, sources of revenue, and scope of programs. State law, therefore, defines responsibilities for environmental functions within the state. Air pollution control, for example, may be designated a health department function, administered by the state, and county, and/or local health departments. There is considerable variation among states as to the amount of autonomy regional and local governments are given. Some local governments are permitted some home rule, while in other states, local governments must seek state enabling legislation for new programs. Only a few states, for example, allow local governments to set their own envirnomental quality standards in addition to state standards.

THE REGIONAL ROLE

In a recent article, Francis B. Francois, a councilman in Prince Georges County, Maryland, stated that:

> "We no longer need to debate "Why Regionalism?" because that is no longer a valid issue. Politicians and the voting public they represent have both recognized that we must solve those problems that fail to stop at our artificial city and county boundary lines, and that it will require more than our own individual local governmental powers to bring about those solutions. The issue for the '70's and the '80's is, 'How are we going to develop and implement the needed regional solutions, and who is going to be responsible for the process?" (1)

This is particularly appropriate for environmental management, where problems can be more effectively addressed on the basis of flood plain, river basin, air basin, and the like.

A variety of regional approaches have been developed, including regional planning commissions, councils of governments, special districts, metropolitan federations, consolidated city/county forms, and compacts. Regional planning commissions and councils of government have become popular approaches to regionalism. These are primarily products of federal planning legislation, recently bolstered by the A-95 review process stemming from Section 204 of the Metropolitan Development Act of 1966 and the Intergovernmental Cooperation Act of 1968. These approaches are popular among local officials because: (1) they do not alter the existing political relationships and, (2) they are multi-purpose in nature and therefore reduce the proliferation of governmental units.

Special districts are perhaps the most prevalent type of regional organization, particularly for environmental programs, e.g., air quality control region, regional sewer district. While offering many of the advantages of regional approaches, single-purpose special districts make comprehensive approaches to regional problems exceptionally difficult. This is especially important in environmental management because complex interrelationships between environmental components, e.g., air and water are characteristic of environmental problems. Plus, the proliferation of the agencies create a serious problem in terms of policy coordination, and public accountability.

Other regional approaches have not proven to be particularly popular. City-county consolidation, for example, has been adopted in only thirteen communities since the end of World War II. Similarly, the United States has not been as active as Canada in pursuing the Metropolitan Federation. Metropolitan Dade County (Miami) is perhaps the closest approximation in this country.

States are beginning to show strong signs of taking the initiative in developing regional approaches to problems. At least two states have moved aggressively to create state-sponsored regional councils: (1) the Twin Cities Metropolitan Council (Minnesota), (described in a paper in this section by Frank Lamm, Director of Environmental Planning for the Metropolitan Council of the Twin Cities Area), and, (2) the Atlanta Regional Commission (Georgia), which has also been given wide authority to coordinate the decisions and programs of local governments in the region.

Also, forty-two states have created a system of sub-state districts covering the entire state. The districts are designed to be the boundaries for federally-sponsored planning programs, councils of governments, and state service areas. In many cases the boundaries have been chosen with the needs of local government firmly in mind. In other cases state decisions have been unilateral. It should be remembered, however, that in many cases the sub-state districts are only on paper, and have yet to be operationalized.

Perhaps the strongest and most widespread trend in recent years has been the activity of the federal government in sponsoring areawide planninng through grants-in-aid. In a study conducted by the staffs of the public interest groups representing local and state government mentioned earlier, (Federally-Sponsored Multijurisdictional Planning and Policy Development Organizations), eleven federal programs sponsoring areawide planning were identified. In a yet to be released and more comprehensive study by the ACIR, twenty-four such multijurisdictional programs were found. These programs have created hundreds of regional planning agencies and poured hundreds of thousands of dollars into the agencies. David Walker, Assistant Director, Advisory Commission on Intergovermental Relations, reported "at last count, there were [to list a few]:

- 481 law enforcement and criminal regions
- 457 Community Action Agencies
- 419 sub-state CAMPS Committees
- 129 regional comprehensive health planning agencies"

The most recent example of federal legislation that initiates a regional agency is Section 208 of the 1972 Water Pollution Control Act Amendments which requires areawide planning to coordinate all water pollution control efforts. The Act gives state governors the first option of designating the areawide planning agencies. If a governor fails to act, the chief elected officials of local governments within an area may make the designation.

THE LOCAL ROLE

Of all the levels of government, local government has the longest history of environmental management. Environmental functions such as water supply, solid waste collection and disposal, and sewage collection and disposal were among the earliest municipal functions. Provision of these services was a local government responsibility which meant that environmental services were quite responsive to local conditions and political process. However, because of the local focus, insufficient attention was paid to the impact of environmental conditions on the surrounding area.

Although some local governments are severely restricted legally and financially from expanding their envronmental focus, many local governments have made dramatic changes during the past few years. Examples of these new local programs include: new organizational arrangements (see Chapter III); greater citizen participation; environmental planning; additional land use controls, e.g., open space zoning, marshland controls, growth controls; adoption of environmental standards, e.g., noise, or performance standards; environmental impact assessment; and, construction of improved facilities.

In many cases, local governments have found it advantageous to join through intergovernmental service agreements, with other local governments on a subregional level for environmental programs. Joseph Zimmerman, Professor of Political Science at the State University of New York at Albany, discussed in greater detail the use of intergovernmental service agreements. Zimmerman found that three-fifths of a sample of local governments utilized this mechanism. He concludes, however, that although service agreements will probably continue in popularity, their use is limited and "pressure for the upward shift of responsibility for problem solving" will increase.

The "New Federalism" has had a major impact on the role of local governments. Revenue sharing and the block grants (including special revenue sharing), place more responsibility on the local decision-making process. This is less important for environmental programs, which thus far have related more to state governments. However, there is a logic to administering as many environmental programs as possible at the local level. Mark Keane, Executive Director, International City Management Association, discussed this issue and went on to emphasize the need to build the capacity of local government to respond to the increased responsibility.

INTERGOVERNMENTAL ISSUES

The intergovernmental issues of environmental management parallel most other program areas. These include: overlapping programs, conflicting (or unrealistic) standards, unreasonable enforcement measures, inadequate participation in policy making, inadequate communication, inadequate technical assistance, uncertainty and delay in program administration, and inadequate funding. The "New Federalism" attempts to resolve some of these problems. However, the failure to clearly sort out the responsibilities of the various levels of government, and the absence of a consistent regional alternative have hampered these efforts. In some cases these problems have created still more conflict.

The future of environmental management in the federal system is open for speculation. It has already been noted that the environment conforms less to the "New Federalism" than most other program areas, in spite of the efforts of EPA. A recent study indicated that approximately eighty percent of a sample of "urban experts" (mayors, administrators, and academicians) predicted that environmental responsibilities would be centralized in the federal government by 1980. (2)

Notes for Chapter VII

[1] Francis B. Francois, "Who Will Make Our Regional Decisions," *Nation's Cities*, November, 1972, p. 12.

[2] Lyle J. Sumek, "Urban Organizations of the Future," Center for Governmental Studies, Northern Illinois University, forthcoming August, 1973.

VII.1 Intergovernmental aspects of environmental controls

Frank P. Grad *

The scope of "environmental law" has seen such rapid expansion in the recent past that any attempt to analyze the part played in it by the federal, state and local governments must first face the problem of selection of an area in which intergovernmental considerations have made a significant difference. Although aspects of conservation and resource development are touched at a number of points, the emphasis of this paper is on the control of environmental pollution—including air and water pollution, solid waste, noise and radiation pollution. There are several reasons for this emphasis. Problems of pollution are the most widespread, and many of their aspects are most acute. Moreover, there is a well-developed technology for the control of many pollutants, and all that is required for their successful management is the proper regulatory machinery, properly staffed and financed. Perhaps more important, environmental pollution is a significant metropolitan and urban problem, and in consequence affects more people than other aspects of environmental pollution commonly requires the efforts of more than any one single government for its control. Indeed, environmental pollution has become an intergovernmental problem because its dimensions can no longer be contained within the narrow boundaries of municipal or local jurisdiction.

The federal role

The historical development of federal involvement in environmental controls has followed a somewhat parallel pattern in almost every aspect of pollution control except in the case of radiation, which the federal government has viewed as a matter of national concern from the very beginning of the development of nuclear energy.[1] In all other areas of environmental controls, however, the federal government has moved from a position of self-denial of powers to an ever stronger assertion of federal interest. This is understandable because the control of the environment—in the traditional sense—for the health, safety and welfare of the people—be it in the area for the exercise of the police power by the several states.[2] The federal government, as a government of limited and delegated powers, had never regarded itself as a repository of a general police power, even though "the federal police power" has sometimes been mentioned in a somewhat metaphoric sense.[3] The federal government has involved itself in environmental controls rather gradually. Reliance on the commerce power in the direct control of pollution is the most recent phenomenon of federal regulation; initially it operated indirectly through the federal government's power to tax and spend for the general welfare. Thus, in most fields of pollution control the federal involvement begins not with an assertion of federal regulatory power but through sponsorship of grant-in-aid programs, with federal standards gradually being imposed as a condition of the receipt of federal funds for purposes of environmental control. This traditional Congressional approach to

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the pollution control problem is exemplified in the policy declaration of the Federal Water Pollution Act of 1948.

> It is hereby declared to be a policy of Congress to recognize, preserve, and protect the primary responsibilities and rights of the States in controlling water pollution.[4]

This limitation on the federal jurisdiction was almost entirely self-imposed.[5] Its justification lay in part in a continued respect for the concept of federalism, and in part in a judgment, probably accurate in 1948, that some form of local control was a more effective means of combating water pollution than federal controls. Consequently, under early water pollution and air pollution control acts the federal function was to operate in full cooperation with state and interstate agencies and with local and municipal governments.[6] When pollution problems worsened rapidly, the wisdom of this secondary federal role was questioned.[7] The result, a new direction of the federal effort, is reflected in the declaration of policy of the Water Quality Control Act of 1965:

> The purpose of this act is to enhance the quality and value of our water resources and to establish a national policy for the prevention, control and abatement of water pollution.[8]

Though the concept of a partnership with the states still remains,[9] the unmistakable trend of federal programs has been to locate the responsibility for final decisions on water quality objectives, standards and priorities in Washington.[10]

Air pollution control

In 1955 the Congress enacted the first federal air pollution legislation. The law was entitled "Air Pollution Control—Research and Technical Assistance."[11] It provided grants-in-aid for state and local air pollution control agencies for research, training and demonstration projects, and gave authority for technical advice and assistance from the federal government. It also authorized the Surgeon General to collect and publish air pollution information. The limited view of the federal role in the 1955 Act is reflected in the Senate Report on the legislation:

> The committee recognized that it is primarily the responsibility of state and local governments to prevent air pollution. The bill does not propose any exercise of police power by the federal government and no provision in it invades the sovereignty of states, counties or cities. There is no attempt to impose standards of purity.[12]

Some eight years later, in the Clean Air Act of 1963, the legislative finding still pair ritual obeisance to the doctrine of primary state responsibility for air pollution control.[13] The Act itself, however, indicated that a major change had taken place in the federal role and in the pattern of federal-state-local relations. It gave the U.S. Public Health Service a far broader role in handling air pollution problems and recognized the need for regional cooperation. While under the 1955 Act grants-in-aid had gone directly from the federal government to the cities, under the 1963 Act the state became the focal point. In addition to grants-in-aid and provisions for research and technical assistance, the Secretary of HEW was authorized to publish non-mandatory air criteria and to encourage and report on efforts to prevent motor vehicle exhaust pollution. Grants-in-aid were also provided for air pollution control programs and, perhaps more significant from the point of view of direct federal regulatory involvement, the law authorized the Secretary of HEW to intervene when air pollution was alleged to endanger "health or welfare," when any state was unable to cope with the problem by itself.[14] The precise nature of these regulatory controls, which have been continued under present federal legislation, will be discussed at greater length in another context.[15] As will presently appear, the 1963 Act, in providing for grants-in-aid to the *states* for air pollution control, exerted an enormous influence in the development and enactment of the states' own air pollution control legislation.[16] Moreover, the 1963 Act, departing considerably from the notion of strictly local control of air pollution, gave recognition to the need for regional planning and provided tangible incentives for regional cooperation in its grants-in-aid program—a larger proportion of the costs of establishing, developing and improving air pollution programs was to be reimbursed by the federal government if the grantee agency was an intermunicipal or interstate agency than if it served only a single city or other governmental unit.[17]

The 1965 amendments to the Clean Air Act moved even more toward direct federal involvement. They authorized the Secretary of HEW to promulgate and enforce federal emission standards for new motor vehicles, without providing for the participation in the standard setting process by the states or localities.[18] This was one of the early instances of clear reliance on the commerce clause as a basis for federal air pollution control. Based on similar constitutional authority, the 1965 amendments enabled the Secretary to act on pollution complaints brought by international agencies or by the Secretary of State. Such action included the ultimate right to bring suit against the polluter.[19]

The Air Quality Act of 1967 brought the federal government squarely into the field of air pollution control. While continuing the provisions of the earlier Clean Air Act for grants-in-aid for research and for other program activities by air pollution control agencies, for the first time the Secretary of HEW was not only authorized but charged with the duty of issuing air quality criteria.[20] The Act specifically required him to designate broad atmospheric areas, and to specify air quality control regions or parts or regions within the state's boundaries. If a state failed to adopt standards of its own, the Secretary was authorized to promulgate standards for the state, following a conference with the appropriate state officials. If requested by the state, a hearing was required before such standards could be promulgated. Moreover, if the state failed to enforce its own standards or failed to enforce the standards set for it by the Secretary, he was authorized to request the Attorney General to commence lawsuits for their enforcement whenever interstate air pollution was involved.[21]

A further change in the direction of greater federal involvement in environmental controls was evidenced by a new power granted by the 1967 Act. The Secretary of HEW was authorized to request the Attorney General to bring an abatement action in any air pollution situation which presented an imminent and substantial danger to health, without the necessity of a prior conference or hearing.[22] Moreover, the Secretary was granted exclusive authority to establish and improve emission standards for new motor vehicles, except in those instances in which a state had adopted a higher standard for new motor vehicles prior to March 30, 1966.[23] In fact, the exception applied only to the State of California, which had adopted such standards.[24] The Secretary was authorized, too, to study the feasibility of national emission standards, and was granted the power to require the regisration of fuel additives.[25] In 1970 the function of the Secretary under the 1963, 1965 and 1967 Acts were transferred to the Administrator of the Environmental Protection Agency.[26] At present, in 1970, legislation is pending in Congress to authorize national emission standards.[27]

It is perhaps noteworthy that the 1967 Air Quality Standards Act not only placed greater emphasis on federal regulatory controls but also deemphasized local controls to a considerable extent. The initial burden for setting standards and for adopting plans for their implementation to meet regional air quality standards is placed on the states, after an appropriate public hearing. There is, moreover, no requirement that the local governments participate in such hearings.[28] The shift from a local to a broader regional, if not national, emphasis was reflected, too, in a number of federal incentives to regional cooperation. To be sure, the encouragement of regional cooperation—and especially the encouragement of interstate compacts—is not exactly unambiguous. While encouraging interstate compacts for air pollution control, the Act expressed the Congressional intention to disapprove any interstate compact which included states not within a federally determined air quality region.[29] This limitation, as will presently appear, aborted three air pollution control compacts on the verge of adoption.[30] However, though the federal attitude towards interstate and regional cooperation is not as liberal as appears on the surface, the Air Quality Standards Act does provide for more substantial financing of air pollution control programs in interstate regions than in intrastate regions, and seeks to stimulate the establishment of air quality standards in interstate air quality regions by paying up to 100 percent of the costs of planning such interstate programs for the first two years and, thereafter, authorizing the payment of up to three-quarters of the expenses of such a program.[31] There is authority also for the Secretary to establish a federal air planning commission for consultation with the respective governors if the states fail to establish interstate air quality planning regions.[32]

The federal role in air pollution control with respect to policy making and standard setting is thus one of limited but increasingly direct involvement. For the present, the federal government merely designates air quality regions and issues air quality criteria which, in a sense, are performance standards. It is up to the states to work out emission standards and plans for their enforcement so as to meet the federal air quality criteria, the performance standard nationally established for designated air quality regions. Though the federal involvement in setting emission standards for automotive pollution is somewhat more direct, this direct involvement in the policing of standards is thus far limited to new cars, the specific area where the federal government has the means of regulation at the source. The imposition of federal standards for emissions generally is as yet in the future. Though the federal government prescribes standards for air quality generally, it is left to the states—and to the localities—to establish the emission standards which industry and others must observe and which the air pollution control personnel must enforce.

Federal environmental regulation

It is evident from the brief survey of the role of the federal government in setting standards and in making regulations for environmental control that most areas have developed along similar lines. Since most aspects of environmental pollution initially appear as subjects appropriate for regulation under the states' police power, the federal interest initially has been to bolster the exercise of the states' and the localities' power through grants-in-aid, grants for research and development, and grants for intergovernmental cooperation in dealing with environmental pollution. As it has become apparent in area after area that environmental problems are not easily susceptible to state or local resolution, but are indeed of regional or national scope, the federal interest has been enlarged and the federal government has taken on more and more of the burden of standard setting and regulation. As will presently appear, standard setting and regulation have not necessarily brought about a more direct federal involvement in enforcement activities for, on the whole, the federal government has traditionally sought to work through state and local instrumentalities in the control of the environment. It is also clear that federal standards—whether direct regulatory standards as in the case of radiation pollution or automotive emission standards, or indirect regulation through the use of the grant-in-aid device—have had an enormously stimulating effect on the states' and localities' own standard setting and rulemaking endeavors. Since the passage of the Air Quality Control Act of 1967, when the federal government first set motor vehicle emission standards, for instance, some 28 states have enacted legislation to deal with vehicle pollution.[33] It is evident, too, that many of the state regulations for water pollution control were passed in response to federal grants conditioned on the states' enforcing appropriate standards, as provided in the 1965 Water Pollution Control Act.[34]

Another aspect of federal involvement controls needs to be mentioned. Until very recently, with the passage of the Environmental Policy Act of 1969,[35] the federal concern for the regulation of environmental pollution has proceeded on a totally piecemeal basis, with each environmental problem being taken up in turn, often without regard to its impact on other aspects of environmental quality. Aside from regulatory controls in the area of air pollution, water pollution, noise pollution, etc., the federal government's own involvement in programs that have significant environmental impact, such as highway, airport and research development activities, has proceeded separate from, and without regard to, the policies implicit in some of the regulatory efforts. The lack of coordination between regulatory programs on the one hand and the broad developmental programs on the other raises a significant question relating to the consistency of federal environmental policy. Unless federal programs with broad environmental implications can be reconciled with federal regulatory efforts in the control of the environment, no sustained coherent federal environmental policy will emerge.

The role of the states

The states and localities have dealt with environmental problems under the states' police power practically from the beginning of time. Much of what is presently referred to as environmental legislation finds its origin in rather primitive early regulations promulgated in the state or local sanitary code as part of the regulation of the public health. So, for instance, the origins of air pollution control can be traced back to early colonial legislation and to even earlier English regulations that dealt with smoking chimneys and the nuisance created by smoke, fly ash and cinders.[36] The origins of water pollution controls may also be found in the early local regulations which prohibited a man from placing his cesspool too close to his own or his neighbor's well.[37] Frequently, such regulations preceded even the scientific knowledge which would have justified them, for the placement of a well near a cesspool was regarded as dangerous even prior to the knowledge that insufficient filtration could cause contamination of the well from the cesspool. So, too, local regulation of noise nuisances antedates by many years the clear evidence that excessive noise results in hearing loss. Thus, there has never been any real question that the states or the municipalities, by delegation from the states, had the power to enact laws or regulations that protect the health, safety and welfare of the people against adverse effects of environmental pollution.

Air pollution control

It is of course a long way from a local smoke ordinance to a sophisticated state or municipal air pollution control code. Generally the states and localities developed such codes in response to federal grant-in-aid programs that made it desirable for them to do so. So, for instance, following the initial federal air pollution legislation in 1955 which provided funds for research and development, the Council of State Governments first called the states' attention to the need for air pollution regulations and proposed some general standards through appropriate recommendations of one of its governors' conferences.[38] Today, almost all states have enacted state air pollution control legislation, some of the most recent enactments have occurred in response to the 1967 Federal Air Quality Act.[39] Typically the state laws designate a state agency or establish a new commission to promulgate standards and codes.[40] In most states the enforcing agency is the state health department,[41] although in some states separate air pollution control agencies have been created.[42] Most of the state laws allow local governments to enact air pollution codes or regulations of their own, but do not generally require it. A number require the state agency, board or commission to encourage local units of government to handle air pollution programs and to provide them with technical advice and assistance.[43] Under most state laws local units of government are empowered to enact laws or ordinances regulating air pollution, but the standards set by such local units must be consistent with, or more stringent than, the state regulations. A few states have even more detailed provisions to insure a coordinated state-local effort. In Florida, for instance, the state agency must review local standards before they become effective,[44] in Colorado the law requires a mutual review—local units must review state regulations and the state agency must review local regulations before either becomes effective.[45] In some states, county and other governmental units are given the authority to study and investigate pesticide problems and to report them to the central air pollution control agency for review and action.[46] A few states, too, require municipalities and other local governments to participate in area-wide regulation, or else to become subject to direct state regulation.[47] Regional cooperation is authorized and provided for in many states' air pollution control laws, though none of them expressly requires it.[48]

A recent draft of model state air pollution control legislation proposed by the Council of State Governments[49] requires local regulatory action by state law in a direct and effective fashion. Section 14 of the proposed law requires municipalities to establish and administer air pollution control programs. Local standards must be stricter than, or at least consistent with, those of the state and must provide for administrative and judicial sanctions. Moreover, the state agency is required to approve the program. If the local unit of government does not act, or, if it does not carry out its responsibilities adequately, the state may, after a hearing, administer the program directly, and may charge the local unit for the expense. Interlocal cooperation is provided for, and the state agency may require area-wide air pollution control programs where considered necessary. If the local units of government do not cooperate in the establishment or administration of such a regional program, the state is authorized to administer the program directly. Finally, if the state agency determines that a particular class of air pollutants is more amenable to state regulation than local regulation, the state may assume exclusive jurisdiction.

The proposed model state air pollution control act is significant in that it deals with a number of problems that have arisen in state air pollution control programs and that existing legislation has failed to address. Generally, state and local air pollution control programs are structurally independent of one another. While the state theoretically exercises supervisory control over local programs, in fact there is considerable disjunctiveness both on the standard setting and on the enforcement level. The state generally exercises little or no supervision over the standards promulgated by local air pollution control agencies and the question of inconsistency between state and local standards is not likely to be raised at all unless a person charged with violating the local code raises the issue in defense to a criminal prosecution or other enforcement action. The disjunctiveness of state and local air pollution control programs within a single state is even more sharply pronounced in the area of enforcement and will be referred to in greater detail in that context.[80]

Originally, one of the most troublesome aspects of state and local air pollution control programs was the composition of the air pollution control agency empowered to set standards and make regulations. Normally state and local air pollution control agencies operate on well-established administrative law principles. The agency is established by law and is given power to promulgate an air pollution control code consisting of emission standards and such other standards as the enabling legislation may refer to in a general fashion. The enabling legislation normally prescribes the membership of the commission or board that is empowered to promulgate the code or other standards under the law.[81] It has been the practice in air pollution control legislation to give substantial representation to the very industries that were the most serious polluters. For many years, membership in standard setting boards in many of the states was based on something of a tripartite formula, with industry having approximately one-third of the seats and with the public, labor groups, and professionals with specific knowledge or interest in air pollution technology holding the other two-thirds.[82] Most of the professionals who were likely to be knowledgeable in air pollution control matters, however, were either employed by industry or were closely identified with industry's point of view. Consequently, many states' air pollution control agencies were for a long time industry-protection oriented, and would not recommend air pollution control measures that were costly or otherwise objectionable to industrial polluters. Moreover, state air pollution control legislation often contained safeguards from the very beginning that were protective of industry.[83] Provisions that require the agency to set air pollution control standards, taking into account "economic feasibility," were especially likely to result in standards that permitted economic factors to outweigh the claims of public health.[84]

State and local air pollution codes differ widely with respect to coverage and technical sophistication. On the most primitive level, all of them deal with visible emissions and set limits (usually in terms of the Ringelman chart) in terms of the density of emissions.[85] Most codes go beyond this primitive smoke-emission standard and deal also with gaseous emissions, whether visible or not.[86] On a yet higher level stand the codes that relate the amount of emission to the amount of heat produced by the apparatus—in effect, requiring minimal standards of heating efficiency.[87] Other, more advanced regulatory approaches limit certain harmful particulate emissions, including process dust, often relating the amount of permissible emissions to the weight of the bulk involved in the manufacturing process.[88] More advanced codes, moreover, impose not merely emissions standards, but also fuel standards, reflecting an appreciation of the fact that the nature of the of the [89] Finally, the most advanced codes provide for a system of emission is directly related to the nature permits and licenses both for the construction of factories, power plants, or other pollution producing installations, and for their operation.[90] The considerable variety in the nature of air pollution control codes is significant because the more sophisticated the code, the more complex the monitoring system, and the more highly trained the personnel required for its enforcement. Particularly in smaller municipalities, the means for the enforcement of a sophisticated code are not likely to be available. In consequence, there are serious limits on the capacity of a local air pollution control agency, for instance, to enforce a highly technical and sophisticated state air pollution control code.

Water pollution control

The history and development of state and local controls in the area of water pollution is again not too dissimilar from that in the area of air pollution. As in the case of air pollution, water pollution control by states and localities is based firmly on the police power.[61] Initially the individual had no realistic protection against water pollution beyond the possibility of a suit for damages and injunction against an upstream polluter.[62] And even private litigation suffered from the absence of any generally accepted standards of water purity against which to measure the degree of pollution.

Initial steps towards government control of water pollution came in the form of measures to protect domestic drinking water supplies[63]—as for instance, the sanitary regulation, previously referred to, that prohibited the placing of one's cesspool too close to one's neighbor's well. Other measures of similar nature took the form of statutes that made the dumping of offal and refuse into the waters a criminal offense.[64] Municipalities were often granted extraterritorial powers to abate pollution contaminating municipal water supplies,[65] and local boards of health were empowered to monitor the quality of water used for domestic purposes.[66] Frequently, however, local success in keeping water supply pure was often achieved by sending wastes downstream, thereby harming other localities.[67]

As pollution became more severe and its threat to the public interest became more apparent, the need for comprehensive state action was realized. In this second evolutionary step, several state agencies were typically given pollution authority in their respective spheres of operation.[68] Where a single agency was assigned primary responsibility it was usually the state health department.[69] This assignment reflected the public concern of the times which focused almost exclusively upon the public health aspects of water pollution. Hines summarizes the main faults of this period as being (1) inadequate statutory authority, (2) lack of forceful administration, (3) inappropriateness of the public health dominion, and (4) lack of centralized authority.[70] These shortcomings became apparent whenever concerted action was required.[71]

The present practice is to create a single state agency and to assign to it the authority to make the major policy decisions relating to all aspects of water quality control.[72] In many states a number of agencies with lesser jurisdiction antedated the creation of the single dominant state agency. Many states, therefore, were faced with the choice of either creating an entirely new agency to assume jurisdiction from all existing ones, of creating a special statutory coordinating board or commission, or of singling out one of the existing agencies and granting it dominant powers over all other water pollution control agencies in the state. An example of the first type of agency is the Texas Water Quality Board. Directed by law to "set water quality standards for the waters in the state . . .," [73] it in effect has achieved major master planning functions in the water areas for the state as a whole. The board is composed of seven members, of whom three are appointed by the governor and confirmed by the Senate; the four others are the chief executives of the Texas Water Development Board, the health department, the Parks Department and the Railroad Commission.[74] Generally, the appointed members are community leaders.[75] An executive director, who is full-time, operates as liaison for the part-time board members and supervises the execution of policies through an appointed staff.[76] Florida, which had initially entrusted water pollution control powers to the Department of Health, ended up by creating the Florida and Water Pollution Control Committee, composed of the governor, the secretary of state, the commissioner of agriculture, and two additional members appointed by the governor and confirmed by the senate.[77] Provision is made for a director with qualifications in bio-environmental or sanitary engineering.[78]

The coordinating committee approach is exemplified by Oklahoma. There the department of pollution control, created in 1968, consists solely of the pollution control coordinating board and of any special task forces that might be assigned to the department.[79] The pollution control coordinating board consists of the chief administrators of the five enforcement agencies—the Oklahoma Water Resources Board, the corporation commission, the state department of health, the state department of agriculture and the state department of wildlife conservation. The board's primary function is to coordinate the efforts of the various agencies in order to avoid duplication of effort and to promote efficient pollution abatement. The board was granted authority to prescribe water quality criteria, standards of water quality and the beneficial uses of the state's waters.[80]

The third approach of vesting control powers in existing agencies was adopted in New York. The New York Public Health Law gave the water resources commission the power to classify waters and to adopt standards. The enforcement of the program, however, was delegated to the State Department of Health. The Water Resources Commission, though it promulgated classifications and standards for the Department of Health to enforce, was an independent body nominally within the structure of the Conservation Department.[81] In April 1970, New York abandoned this structure, transferring the functions of the Water Resources Commission and the Conservation Department to a newly created Department of Environmental matters.[82]

A number of state water pollution control efforts have been criticized on structural grounds—it is said that separating standard setting and rule making powers from enforcement powers has proved unsatisfactory. According to this view, the coordinating committee would seem likely to be the least effective form of agency since by definition it has coordinating powers only and may not enforce directly. Conversely, a centralized agency, such as that of Texas, with its own staff and extensive enforcement authority, is likely to be far more effective. It has been charged, for instance, that the reason for the lack of effectiveness of the old New York law was the absence of close coordination and cooperation between the Water Resources Commission, the policy maker, and the Department of Health, the enforcement agency.[83] The implications of separating standard setting and rule making from enforcement responsibilities ought to be taken into account when considering the recent trend towards the establishment of coordinating and standard setting agencies for environmental controls at large. There is evidence that the establishment of coordinating agencies, or the separation of policy making from enforcement activities is of dubious effectiveness even within any one field of pollution control, such as water or air pollution. Why, then, should there be greater effectiveness expected of a state-wide pollution control agency with responsibility for policy-making in water pollution, air pollution, noise pollution, solid waste disposal and all the rest, but leaving enforcement responsibilities to specific divisions within the overall pollution control agency? That is not to say, however, that interagency coordination is not both desirable and necessary. It is true, for instance, that water pollution problems cut across many lines of interest and require many different kinds of technical knowledge.[84] Even a unified water pollution control department may find it difficult to administer its program if it does not take cognizance of the expertise and interests of other agencies.

The composition of water pollution control boards differs from state to state but, just as in the case of air pollution control boards, follows a number of set patterns. When a board's function is primarily advisory, the representation of interests on the board is likely to be very broad,[46] although some advisory boards consist wholly of officials of state agencies involved in various aspects of water pollution control, serving on the board *ex officio*. In many instances advisory boards or boards charged with standard setting functions consist of officials of enforcement agencies and of persons representing interests most directly concerned with the regulation of pollution.[47] Ordinarily, when a water pollution control body has not only supervisory or standard setting authority but also exercises enforcement functions, it is likely to be composed primarily of agency officials.[48] The question of whether or not it is desirable to include members of the regulated industry on a standard setting or rule making body has been previously referred to in the context of air pollution regulation. It has been suggested in the context of water pollution control that the members of the regulated industry, who are likely to be the major contributors to the pollution that is sought to be regulated, should not be given an official position in the standard setting agency because their views have usually been adequately represented in the legislature in the course of legislative hearings, and by counsel in board hearings on proposed regulations. It is likely that in water pollution standard setting agencies, just as air pollution standard setting agencies, the presence of industry board members has hindered the regulatory effort by at least as much as it has advanced it.[49]

State agencies differ considerably with respect to their jurisdictional scope, and this of course has considerable implications for the kinds of standards and the reach of the regulations that they may impose. Some state statutes limit agency jurisdiction by giving it regulatory control only over specified waters, or by exempting certain waters from regulation.[50] Other states exempt ground water pollution thereby ignoring the integral relation between the quality of ground waters and surface waters.[51] The more up-to-date and comprehensive statutes generally and expressly include *all* waters within the pollution control effort.[52] The presence of certain political and economic pressures is clearly visible on the face of certain of the water pollution control statutes. Thus, for example, Pennsylvania makes its act applicable only to sewage and exempts from coverage all wastes from coal mines, tannery and municipal sewage systems existing at the time the act was passed.[53] Sometimes, too, the regulatory scope of the law is limited by a very narrow definition of the wastes capable of creating a condition of pollution.[54] It is clear that inclusive coverage is not difficult to achieve statutorily through a broad grant of jurisdiction and a liberal definition of activities to be regulated.[55]

State agencies' powers differ considerably with respect to the kind of water quality standards they may impose. Though on their face modern state water pollution control laws grant broad powers to the control agency,[56] not all of them grant full powers to the agency to set water quality standards across the board. Many states that have the power to establish water quality standards are approaching the task in gradual stages. Some states have never gotten beyond the promulgation of broad minimal standards, while other states have not set statewide standards but have proceeded area by area.[57]

The New York law and the regulations promulgated under it offer a good example of a comprehensive program of water classification and the adoption of quality standards. The waters are classified on a "best use" basis, which means that the existing or potential use requiring the highest degree of purity is used to set the standard.[58] Public hearings are required in the standard setting process. Standards of purity are assigned to the various rivers and streams based on the following criteria:

1. Stream characteristics, including size, temperature, and drainage area;
2. Character and use of the surrounding area;
3. Existing and potential uses of the stream; and
4. The extent of present deflement or pollution.[99]

In order to avoid standards from becoming permanently fixed at too low a level of quality, the New York Water Resources Commission had the power to repeal, modify, or alter standards from time to time. The water classification program in New York has been attacked as an unconstitutional delegation of legislative authority. The constitutionality of the law and the regulations were upheld, however, by the highest court of the state.[100] Similar water classification schemes have been upheld in other states against constitutional attacks based not only on improper delegation but also on due process and equal protection grounds.[101]

Where a state's water pollution regulations have been adopted, there is relatively less scope for rule making on the local level, except insofar as such local regulatory efforts may be expressly sanctioned or authorized by state law. In the main, however, the local regulatory effort is likely to support the state effort by assisting the municipality in meeting the requirements imposed on it by state law. This happens to be one of the unusual areas of the law in which local governments have been sued by state water pollution control agencies to compel compliance with state regulations. This is particularly true in instances where the locality has failed to provide adequate sewage treatment facilities to treat raw sewage before it is discharged into one of the state's waterways.[102]

In many localities local subdivision regulations require developers of entire subdivisions or developers of sizeable tracts to provide for community disposal systems and for community-operated treatment plants instead of individual septic tanks.[103] The aim is to help meet the state's water purity standards. In many jurisdictions, developers may not proceed with building operations until the local agency has been assured—by way of submission of plans for certification—of the developer's intention to make adequate provision for sewage treatment in his development.[104]

In water pollution control there has been far closer correlation between state and local agencies than in air pollution. In the case of water pollution the problem is generally well defined by a river bed which touches many municipalities within the state. Consequently, the failure to conform on the part of one municipal agency becomes immediately apparent not only to the state agency but to all other municipal agencies downstream. The problem of air pollution is far less well defined because air pollution, though it may move with prevailing winds, does not move in clearly defined channels, and the contribution of any one municipality to the total amount of air pollution in a region is not only difficult to gauge but also difficult to prevent. Consequently, disjunctiveness of effort in the air pollution control field is less likely to become immediately apparent than would be a similar disjunctiveness of effort in water pollution control.

Solid waste disposal

Other areas of environmental control, such as solid waste disposal and noise control are by their nature far more local in character, and in each instance the federal concern is thus far reflected primarily in grants-in-aid legislation for research and development and, to a far more limited degree, in federal regulations.[105] Solid waste disposal has been handled thus far by local regulation, generally subject to state enabling legislation.[106] The manner in which solid waste is to be collected, the manner in which the householder is to store his solid waste and get it ready for collection is generally treated in state or local sanitary, health,[107] or housing codes.[108] The subsequent disposition of wastes collected by municipal sanitation departments or by private garbage collectors is also regulated by local ordinances, subject again in most instances to state enabling legislation.[109] Thus the proper method for sanitary landfills and the required quality of clean soil to bury waste are regulated by state or local health codes.[110] The manner in which wastes may be incinerated, either in a municipality incinerator or in a privately operated incinerator, or by burning on the lot, is generally subject to state or local air pollution control regulations.[111] What is noteworthy in this context is the fact that the relationship of solid waste management to air pollution control or to water pollution control is not articulated in any state law or regulation—in spite of the fact that some jurisdictions have had that connection brought to their attention—rather forcefully—as in New York, where an order to shut down apartment house incinerators led to a garbage removal crisis.[112]

The statutory treatment of solid waste disposal is also interesting, in that it appears to be concerned to a far greater extent with the economic rather than the environmental aspects of the problem. Provisions for the issuance of bonds for incinerators and other disposal systems abound, and special districts for this purpose are sometimes authorized.[113] In large cities, considerably more attention is devoted to the licensure of private garbage collectors—a sometimes racket-ridden industry—than to the sanitary aspects of waste collection and movement.

On the whole, state laws relating to solid waste disposal exist in their own statutory compartment just as does water pollution and air pollution control legislation.[114] While some states are beginning to reflect the recognition of the interrelationship of different committees and agencies of various kinds, no effective means appears to have been found as yet to reflect the close interrelationship of these matters in operative regulations.

Noise Pollution Control

The subject of noise regulation is in some respects unique; though there has been some recent federal development in the area,[115] the states and the municipalities have on the whole dealt with quite distinct aspects of it. State regulation of noise is essentially limited to muffler legislation intended to reduce noise produced by motor vehicles,[116] and to regulations relating to industrial noise for the protection of workmen.[117] Aside from these two separate areas, the regulation of noise has been largely a local responsibility, and the local regulation involved has been of a rather minor kind, namely the establishment of miscellaneous prohibitions collected in local codes under some such heading as "police ordinances." Usually these are composed of matters too trivial to appear in the state's general code, and they generally concern matters too neglected in modern times to be included in public health law or the like.

The fact that the states have generally not legislated against noise and that such local laws as exist are largely recompilations of old ordinances, suggests that very little attention is presently being paid to the problem and that there is little expectation that the local laws will be actively enforced. This point is substantiated by looking at the anti-noise laws in a few American cities. In New York City, the relevant provision of the Administrative Code prohibits "the creation of any unreasonably loud, disturbing, or unnecessary noise" or of "noise of such character, intensity and duration as to be detrimental to the life or health of any individual." [118] This is followed by a list of specific acts that "among others" shall be deemed to be violations of the general prohibition. Some of these themselves are phrased in terms or "loud" or "unnecessary" or "disturbing" noises of various kinds. Included, too, are such concrete examples as horn blowing, except as a danger signal, failure to use a muffler, and construction work between 7 p.m. and 6 a.m.

on weekdays except by special permit. Other provisions regulate sound trucks and other amplifying devices used in public.[119] Philadelphia's code of ordinances prohibits unnecessary noise in the handling of trash cans, and construction work between 6 p.m. and 6 a.m. It also contains special provisions to protect the quiet of hospitals, churches, court houses and schools, and prohibits the use of outdoor amplifying devices for advertising purposes, unnecessary horn blowing and "all other loud and unnecessary noises upon or near to the streets or other public places in the city," and provides for the regulation of street peddlers.[120] Chicago, in addition to some of the more standard provisions, provides that "rails, chimneys, and columns of iron, steel, and other metal which are being transported on the public ways of the city" shall be loaded so as to avoid the creation of loud noises.[121]

What all of these city ordinances lack is a coherent scheme of noise control. Typically they are collections of specific prohibitions drafted and enacted from time to time by the local legislative body in response to some special problem, and not subject to revision, review and updating by an administrative agency having the requisite expertise to deal with noise problems in a consistent fashion. There are, however, some notable improvements on the horizon. Modern zoning ordinances, especially the 1960 New York City Zoning Resolution, deal with industrial noise and similar environmental insults, such as vibrations, not only by the ordinary zoning technique of requiring separation of incompatible uses, but also by imposing specific performance standards for the more frequent pollutants. Thus decibel standards for particular zones are imposed to set permissible standards for noise, just as standards for vibrations, smoke, dust and other particulate air pollutants, odor, toxic emissions, fire and explosive hazards and other onerous environmental hazards are dealt with in relation to the use of particular zones for designated purposes.[122] A modern zoning ordinance also can, and should, deal effectively with the problem of effective airport zoning. Certain facilities—such as schools or hospitals—should be excluded from neighboring zones unless properly sound-oriented. Imaginative use of the zoning power can protect the airport without placing a complete bar on other development in the area.

At least two building codes, in New York[123] and in New Jersey,[124] require sound insulation in new buildings as a condition of a building permit or a certificate of occupancy. In addition to requiring adequate sound insulation against noise from outside the building or from other parts of the building, these codes also provide for adequate protection against noise sources from within the building itself—i.e., ventilation and heating equipment, elevators, ducts and other machinery and facilities.

Unlike earlier municipal noise regulations which were enacted from time to time by municipal legislatures, these newer regulatory efforts are not only more comprehensive but are also the result of technical work done by knowledgeable and technically qualified administrative agencies with special competence in the field.

The role of the federal government

While there has been a gradual move towards the consolidation of standard setting responsibilities at higher levels of government, the major responsibility for seeing that air pollution, water pollution and other environmental standards are actually enforced rests at the lower level of the governmental hiearchy.[125] In part, the fact that the responsibility for enforcement activities is not centered at the federal level reflects the earlier assumption that environmental controls are primarily a local responsibility. In part, too, the primary emphasis on enforcement powers at the local or state level reflects the realistic appreciation that there is local and state enforcement machinery—i.e., a staff of inspectors and force of clerical back-up personnel—while there are very few federal enforcement officials who are concerned with matters of day-to-day enforcement against individual violators of the standards, rules and regulations.

The consequence of a predominantly local emphasis in enforcement is that in air pollution and water pollution control, as well as in any number of other areas of environmental protection, federal enforcement against persons who violate standards is not only infrequent but is viewed as a rather extraordinary measure.

As constituted in 1970, federal law provides for federal abatement procedures in four separate situations. If solely intrastate air pollution is involved, the Administrator of the EPA may take action only if requested by the governor of the affected state. But he may not proceed if he determines that the effect of such pollution is not of such significance as to warrant the exercise of federal jurisdiction.[106]

A second procedure, added in 1967, authorizes the Administrator to seek immediate court action to stop emission of pollutants where there is evidence of "imminent and substantial endangerment to the health of persons" and where state or local authorities have failed to act.[107] The section is intended as a remedy for emergency situations only, and the Congressional intent embodied in the House Report that accompanied the legislation was clearly to make the remedy inapplicable as a continuing control for chronic or generally recurring problems of less than calamitous nature.[108] Local authorities do not have the power to require the Administrator to act under this section. The Congressional intent regarding the section was clearly to have it used only in such extraordinary situations.

A third procedure is provided for if the interstate air pollution occurs in an air quality control region with established air quality standards.[109] Federal enforcement is authorized only if the Secretary finds that air quality has fallen below the prescribed standards, and that the state itself has failed to take reasonable action to implement and enforce the applicable standards.[110] While the Administrator may act on the basis of the complaint from one of the states affected, he is not required to act on the basis of such a state complaint, and it is up to him to determine whether the state complained of has or has not taken "reasonable action" to bring about abatement.

Finally, the fourth procedure which may bring the federal government into an active enforcement role is that which was initially provided by Section 105 of the Clean Air Act of 1963. The procedure is applicable only in instances of interstate air pollution where the source of the pollution is in one state and the adverse effect in another. The Administrator is required to call a conference whenever requested to do so by the governor or by a state air pollution control agency of one of the states affected, or with their concurrence, by a municipality, if there is evidence of air pollution "which is alleged to endanger the health or welfare of persons in a state other than that in which the discharge originate(s)." [111] The Administrator is also free to call a conference on interstate air pollution on his own initiative after consultation with the officials of the affected states.[112] It is noteworthy that this is the only instance under the law in which a state or municipality can require the Administrator to act. However, an individual citizen cannot require him to act under this or any other federal enforcement provision.

When a conference is called by the Administrator, the interstate, state and local agencies involved participate in it, and an appointee of the Administrator presides. The person responsible for the discharge may be invited by one of the member agencies, but there is no legal requirement that he attend the conference, and it has been held that due process does not require his presence since the conference is neither rule-making nor adjudicative.[113] The conference meets on thirty days' notice accompanied by a preliminary report made by EPA. Advance notice is also given to the public by publication on at least three different days in a newspaper of general circulation in the area.[134] The conference itself is informal and does not have the character of an administrative hearing.[135] Following the conference, EPA prepares and distributes a summary of the conference discussions, and the Administrator may recommend necessary remedial action. The law provides that the polluter must be allowed six months to take the remedial action recommended. If six months later the Administrator is dissatisfied with the progress made, he may call a formal public hearing before a hearing board of five or more persons appointed by him. Each of the states affected may choose one member, and each federal department which the Administrator determines has a special interest in the matter may choose one member. One member must be a representative of an appropriate interstate air pollution control agency, and a majority of the members must be persons other than officers or employees of EPA[136] The appointment of a formal hearing board is entirely at the discretion of the Administrator,[137] and the complaining state or municipality has no role in the initiation of this step. All interested persons must be given an opportunity to present evidence at the hearing, and the board makes recommendations for affirmative action to abate the pollution on the basis of the evidence presented. The findings and recommendations of the board are forwarded by the Administrator to the alleged violator and to the agencies involved, together with a notice specifying a reasonable time of not less than six months for compliance.[138] Neither the board nor the Administrator has been granted authority to issue a binding order following the hearing, and the Administrator is not authorized to impose any sanctions for the violator's failure to comply with the directives of the conference. It has been held that, though more formal in character, the hearing is not adjudicative and the alleged violator cannot obtain a judicial review at this stage for he has not as yet been subjected to any legally binding order.[139] If the alleged violator, however, fails to comply with the hearing board's directions within the time set for such compliance, the Administrator may then ask the Attorney General to file suit in the federal district court to secure abatement.[140] This is the first and only instance in the lengthy procedure that a sanction has been provided for failure to comply. However, the complaining state or municipality cannot require the Administrator to take this step. Whether or not the Administrator decides to ask the Attorney General to file suit is again left entirely to his own discretion. When suit is brought, the court may receive any transcript of the proceedings before the board and a copy of the board's recommendations, along with any other evidence which the court deems proper.[141] The board's findings and recommendations will not be received as evidence to prove any facts recounted in them, but will be evidence only as to what the public interest and the equities of the case may require. Both the government and the defendant have an opportunity to produce additional evidence.[142] The court considers all pertinent factual and legal issues *de novo* and in making its determination,

> The court, giving due consideration to the practicability of complying with such standards as may be applicable and to the physical and economic feasibility of securing abatement of any pollution proved, shall have jurisdiction to enter judgment, as the public interest and the equities of the case may require.[143]

Although this procedure has been available since the enactment of the Clean Air Act of 1963, its effectiveness has been minimal. It is most cumbersome and slow, and in the past seven years it has been invoked in only nine interstate areas.[144] In only one instance, moreover, has the case gone beyond the conference recommendation state, i.e., beyond the very first formal step. That case involved the Bishop Processing Company of Bishop, Maryland, which was charged with emitting such vile odors from its chicken offal processing plant as to endanger the health and welfare of persons in Selbyville, Delaware, two miles distant. In that case, administrative proceedings were initiated by a request from the Delaware State Air Pollution Authority which, with the state of Maryland, had been engaged in futile efforts since 1959 to induce Bishop to abate its pollution. A formal hearing was subsequently held in May of 1967 after the company had failed to make satisfactory abatement efforts. The company was directed, following the hearing, to abate the pollution by December, 1967. On July 28, 1968, some two and a half years after the proceedings had begun, the district court in Maryland denied the company's motion to dismiss the government's suit seeking abatement. In the fall of 1968 the Bishop Company agreed to a settlement requiring it to cease operations upon the filing of an affidavit by the Delaware Water and Air Resources Commission, stating that the company was causing air pollution in Delaware. The affidavit was not filed until March of 1969. In September an order was issued directing the company to cease operations. The order was, however, stayed during Bishop's appeals to the Court of Appeals and Supreme Court and did not become final until spring of 1970—five years after the inception of the federal procedure and eleven years after the state governments first became concerned with the situation.[145]

The range of federal enforcement powers under federal water pollution control legislation, as amended by the Clean Water Restoration Act of 1966, is similar to—and appears to have been copied from—that in the air pollution area. The bases for federal intervention, closely paralleling those in air pollution, are: (1) pollution of interstate and navigable waters in or adjacent to any state or states that endangers the health or welfare of any persons, (2) a governor's request for federal intervention when pollution in one state affects the health or welfare of persons in another, "unless the effect of such pollution on the legitimate uses of the waters . . . is not of sufficient significance to warrant federal jurisdiction."[146] In addition, action may also be instituted when the Administrator of the EPA has reason to believe that pollution in interstate or navigable waters creates substantial economic injury resulting from inability to market shellfish or shellfish products in interstate commerce, and, finally, whenever the Administrator has reason to believe that pollution of interstate or navigable waters endangers the health or welfare of persons in a foreign country and the Secretary of State has requested him to abate such pollution.[147] The procedure consists of three stages. First, a conference with participation by state and interstate agencies and the alleged polluters, followed by recommendation by the Federal Water Pollution Control Administration to the state agency to take action within a period of not less than six months. Second, a formal hearing before a board appointed by the Administrator, and, after such hearing, again a direction that abatement measures be taken within a reasonable time of not less than six months. Finally, a discretionary request by the Administrator to the Attorney General to bring suit for an injunction on behalf of the United States.[148] Some 43 informal conferences were held through 1968; only four continued to the hearing stage. Of these, only a single case was taken to court.[149] Another provision allows compliance action by the Attorney General upon 180 days' notice to the polluter; no court action has as yet been taken under it.[150]

Both in air and water pollution enforcement, the federal government relies primarily on informal negotiations rather than on hard enforcement, for it is clear that the established enforcement devices do not meet the need for the swift and decisive action that may be necessary. Hence federal enforcement under both the air and water pollution control acts is only as effective as informal procedures prior to court action can make it. This is well in line with long accepted principles of public health compliance techniques which rely primarily on education and on negotiated cooperative measures.[181] It is clear, however, that these measures are not designed to gain compliance from a hard-core violator who sees no immediate reason for prompt compliance when it is costly and burdensome. Under both the federal air and water pollution control acts such a violator knows that he has two to three years from the time when the federal government commences its laborious proceedings until he may actually be compelled to take abatement measures. There is virtually no incentive for him to take earlier action, because neither the Air Quality Standards Act nor the Clean Water Restoration Act penalizes his delays—no fines or other sanctions are provided for dilatory action.

Federal regulations with respect to aircraft noise appear to be preemptive in intent.[182] While both the courts and the Federal Aviation Administration have asserted that operators of airports have the ultimate right to decide which aircraft can or cannot use their facilities as long as their judgment is not discriminatory, whatever decisional law there is seems to hold that local governments may not pass airport noise regulations or ordinances more stringent than the standards adopted by the FAA—though they may promulgate such standards in their proprietary capacity as airport operator.[183] Thus, although there has been considerable dissatisfaction with the federal aircraft noise standards,[184] municipalities have been severely handicapped in defending their inhabitants against excessive noise from aircraft in interstate commerce. The suggestion is readily at hand that preemptive federal standards, both for automotive emissions and aircraft noise, are as much designed to protect the particular industries affected against more stringent controls by the states and municipalities as they are to protect the public.[185] This point may gain in force in light of recent federal participation in the development of the supersonic transport plane, for the regulation of sonic boom, it seems, is also a federal monopoly under the same legislation that authorizes FAA regulation of aircraft noise.[186]

Difficulties created by partial federal preemption of a field are demonstrated too by the current state of the law with respect to the control of jet plane noise. The federal regulations set by FAA are preemptive in that no state or local government may set higher standards than the standards established by the federal agency. On the other hand, the federal agency has repeatedly stated that its regulations provide a minimum requirement only and that the proprietors and operators of airports throughout the nation are free to set standards of their own—i.e., each airport may decide that it will not permit its facilities to be used by planes that exceed a noise level set by that airport even though the level set by the airport itself may be higher than that set by FAA.[187] In actual fact the purported permission to airports to set standards of their own is wholly illusory because, as a practical matter, airport operators cannot enforce higher standards. In this instance the federal standard is entirely more preemptive than it purports to be. The assertion that it is not wholly preemptive serves the purpose of the federal regulatory agency, however, because whenever the federal standard comes under attack, the agency can respond that the local airport is free to require more stringent compliance if it wants to do so. Here, too, federal preemption has created a no-man's land in which there is federal abstension from standard-setting without any concomitant grant of power to the state or municipality to take up the slack.

The roles of the states in air pollution control

Regulations to control environmental pollution are generally enforced on the state or local level. If they are enforced at all. Whether particular enforcement efforts are the responsibility of a state agency or local agencies depends on the state's administrative or structural arrangements. In most states the agency primarily responsible for environmental controls is still the state health department.[158] State health departments differ from state to state with respect to the degree of centralization and the degree of their interrelation with local health agencies. In some states the department operates primarily as a standard setting or rule making agency which may have advisory and other "staff" functions for the state as a whole, but which takes little or no "line" responsibility for the activities of individual municipal or county health departments. In many instances the supervision by the state health agency of the activities of local or municipal health department does not supervise the day-to-day operations of local or municipal agencies, and may be called in only to take steps when some major failure on the part of municipal or local health agencies has occurred.[159] In other states the responsibility for enforcement of health laws and regulations is much more centralized in the state health department, with county and municipal health agencies directly responsible for their routine performance, and accountable to the state health agency for all of their programs.[160] In those instances a true "line" relationship exists between the local or municipal health agency and the state health department. A variety of more or less intermediate patterns exists, but in almost every instance the primary responsibility for standard setting and rule making is in the state health agency, and the actual enforcement function is lodged lower down in the hierarchy—whether or not the local agencies are directly responsible to the state agency or operate more or less independently from it.

The relationship of state health departments to county and municipal health departments is further affected by a variety of legal relationships dependent on the state constitution and on legislation that defines the relationship of counties and municipalities to the state generally. In many states, for instance, incorporated municipalities, such as villages and cities, will have health departments of their own, and in addition there will be a county health department which may or may not be an administrative branch of the state health department. This county health department will commonly have jurisdiction to operate within the unincorporated areas of the county, but each of the cities and villages will be free to regulate its own affairs, consistent, however, with whatever standards the state health agency may have prescribed for the state as a whole.[161] Moreover, the extent to which health departments in incorporated municipalities, such as villages and cities, may manage their own affairs may depend to a considerable extent on the degree of home rule granted to such municipalities, either by state constitution or general municipal legislation, or by their own individual charters. In terms of air pollution legislation, for instance this means that there is likely to be a statewide air pollution control code[162] to meet the requirements of the 1967 Air Quality Standards Act for the air quality regions federally determined for that state. This statewide air pollution control act and the state code adopted pursuant to it indubitably set the minimum standard for the entire state. These standards are probably the only standards applicable to the unincorporated areas within the state. Additional requirements may have been set by a county air pollution control agency, and these standards though consistent with the state code, may be higher for the county as a whole.[163] The county standards, depending on some of the factors previously mentioned, may apply to the entire county or merely to its unincorporated areas—or it may apply to all of the unincorporated areas in the county and to such of the incorporated areas, i.e., villages and cities, that have not adopted air pollution control codes of their own. Any major city, however, particularly if it has a substantial amount of industry, is likely to have an air pollution control code of its own which will have to be consistent with the county code, if any, and certainly with the state code. It may be more stringent than either one of them, particularly if it can be shown that the municipality has special problems of pollution caused by particular topographical or industrial features that are not shared by the rest of the county or state.[164]

The question raised by this array of overlapping, albeit supposedly consistent, codes is which agency enforces any one air pollution control code. As a rule of thumb it may be stated that each municipality or other jurisdictional entity enforces its own code, without much regard to the code of the next higher jurisdiction in the hierarchy.[165] Each municipal air pollution control agency has a staff of air pollution inspectors and some monitoring or other surveillance equipment of its own, and each of these staffs and their equipment are used for the purpose of cutting down on emissions from within the jurisdiction so as to accomplish compliance wtih that jurisdiction's code. None of the municipalities have extraterritorial powers, and in practice, each jurisdiction can abate only the emissions emanating from sources of pollution within its own borders.[166] Thus the air pollution inspector is stopped aboslutely in his enforcement efforts by the local boundary line. If City A has the most advanced air pollution control code but receives most of its pollution from industrial sources in City B located within the same county, the air pollution control inspector of City A cannot enter City B to serve a violation notice on the industrial pollution source in B. Only the air pollution control inspectors in City B can do so.[167] If the main consequence of emissions in B is pollution fallout in A, and if the source in B is a major employer of B's population, enforcement may not be overly zealous. There is also a question in many states whether the air pollution control inspector of the county in which both A and B are located can go into either of the cities to serve a violation notice because he, in turn, may be limited by provisions of law that grant enforcement powers within their own boundaries to incorporated municipalities. While air pollution is no respecter of jurisdictional boundaries, air pollution control agencies are, by reason of the law under which they operate. The consequence of jurisdictional limits on enforcement has frequently been to render helpless municipalities which themselves produce few emissions but which, by reason of topography or prevailing wind, receive all or most of the fallout from neighboring municipalities. There are even a number of instances on record when inventive owners of manufacturing establishments combined to incorporate industrial enclaves as cities or villages, as a defensive measure against the imposition of pollution controls.[168] Thus a highly industrial area with a daytime working population of several thousand persons and a nighttime population limited to a few watchmen may effectively eliminate the possibility of having environmental pollution controls enforced against them. All of the surrounding residential communities may enact the most sophisticated air pollution control ordinances, but since the source of emissions is in another incorporated area, the residential community's air pollution control codes will have little effect, because its air pollution control agency has no jurisdiction to enter the incorporated industrial area for purposes of enforcement. The only possibility to secure adequate enforcement under such circumstances is to grant enforcement powers for county and state agencies even within the incorporated area. In the past, however, enforcement staffs have been lodged at the local level and in many states where the structure of health departments depended on local enforcement efforts, there was no effective enforcement staff on the state or county level. These structural hindrances to effective environmental controls are not the result of willful obtuseness on the part of state or local officials. When the business of health departments consisted primarily of epidemiologic controls or of controls of food establishments, eating places, etc., the kind of division of labor between state, county and local departments involved here made good sense and was appropriate to the problems for which it was designed. It is only the realization that environmental problems have spread beyond narrow jurisdictional boundaries and affect incorporated and unincorporated areas alike that makes much of the traditional governmental machinery for public health enforcement archaic and inappropriate for the uses to which it must be put.

Water pollution control

A somewhat different pattern of enforcement is encountered in the field of water pollution control. The municipalities generally are in charge of enforcing certain aspects of the purity of the water supply—i.e., it is generally the municipality's job, either under appropriate health code regulations or under subdivision ordinances, to see to it that necessary septic tanks and private sewage disposal systems are built and that they are built in a manner that will prevent pollution of well water and other sources of water supply.[169] Normally non-compliance is punishable as a misdemeanor,[170] and usually the construction of a private sewage disposal system requires a permit from the local health agency with the frequent requirement that the system not be covered up or buried before a sanitary inspector has had an opportunity of checking it.[171] In addition, the municipality generally is in charge of enforcement against malfunctioning private sewage disposal system and usually has the power of summary abatement if these systems develop in to nuisances.[172] The municipality may have a requirement, too, that as soon as public sewers become available, the householder is under an obligation to connect his own facilities to the public sewer, paying whatever special assessments there may be for that service.[173] In some instances, subdivision developers may be compelled by local law to provide community sewage treatment plants for the development as a whole.[174]

Aside from local enforcement of the nature previously mentioned, water pollution control is generally lodged at either the state level or the regional water basin level in those instances when the state relies on separate agencies for separate river systems rather than on a central water pollution control agency.[175] In either case, the agency may itself seek out violations of standards through inspections or through a monitoring system, or it may respond to complaints.[176] Most state laws require that a hearing be held whenever a probable violation is discovered and that the alleged violators be afforded an opportunity to appear and answer the charges.[177] Some state laws contain provisions for emergency procedures that allow the agency to dispense with hearing prior to issuing an order; under those circumstances a hearing must normally be held as soon as possible after the order has been issued.[178] Following the hearing, the usual remedy is the issuance of a cease and desist order.[179] In New York, for instance, the Commissioner may issue "such final order or make such final determinations as he deems appropriate under the circumstances."[180] Failure to comply with such an order may generally be penalized by both civil and criminal sanctions. Violations are usually treated as misdemeanors.[181] Civil penalties are recoverable separately by civil action. The range of penalties for failure to live up to water quality standards is rather wide from state to state, just as is the range of penalties for air pollution violations. In some states, the maximum fine may range only up to one or two hundred dollars per violation. In others it may go as high as $3,000. In Florida, for instance, the civil penalty is $1,000 for each offense, and the criminal penalty for a misdemeanor is a thousand dollar fine and a year in jail for each offense.[182] In New York the criminal penalty may include fines from five to twenty-five hundred dollars and imprisonment of up to one year for each offense.[183] In a number of states, each day of non-compliance may legally constitute a separate ofense.[184] Most state statutes also provide for injunctive relief when violator has failed to comply with earlier agency orders.[185] All of the state laws provide for judicial appeal and for review of agency orders.[186] Generally such a review will be based on the record of the hearing before the agency,[187] although a minority of jurisdictions require a *de novo* review by the courts.[188]

Although enforcement procedures under state water pollution control acts are fairly similar throughout the country, enforcement in different states varies considerably in effectiveness.[189] The major reason for such differences appears to be the relative aggressiveness of the responsible agency.[190] Water pollution control is one of the few areas of enforcement in which a significant number of cases can be found where the state agency has actually sued a municipality to compel compliance by the local government with state standards relating to sewage treatment water purity and permissible emissions.[191]

Solid waste disposal

With respect to solid waste disposal, enforcement is an entirely local matter. As has been pointed out previously, many states have extensive legislation dealing with the municipality's obligation to collect wastes and to dispose of them either by incineration or by sanitary landfill methods. Almost all municipalities have detailed regulations with respect to placement of wastes outside the home for collection and many of them go into significant detail with respect to the kind of containers that are permissible, where they may be placed and how soon they must be taken in after trash and other wastes have been picked up.[192] Violations of such laws and regulations are generally treated as minor misdemeanors, and the fines imposed are likely to be very low.[193] Sanitary landfills, however, may be subject to a system of licensure in some jurisdictions.[194] A number of municipalities have enacted some special legislation or regulations to deal with the ever increasing problem of the thousands of old automobiles that are junked or abandoned at the roadside.[195] Generally the trend of such legislation or regulation is to provide both penalties for unlawful abandonment of old cars and a service program to make it easier to leave old cars for sanitation department pickup instead of abandoning them to become an eyesore and a possible hazard. Again, the responsibility for enforcement is generally that of the municipality, which is handicapped in applying the criminal sanctions because the ownership of abandoned cars is usually very difficult to trace after the license plates have been removed.[196]

Noise pollution control

Enforcement of noise control, traditionally a matter of local concern, generally involves police prosecution, with minor criminal penalties.[197] The states however, have long exercised jurisdiction over industrial noise through their industrial codes administered by the state labor department. Criminal penalties for violations, as well as cease and desist orders and injunctive relief are commonly available; administrative procedures before the state labor department usually precede prosecutive and other judicial remedies.[198] With the greater concern for automobile noise, state muffler legislation has become almost universal, and violations are commonly punishable as misdemeanors.[199] In addition, such legislation is also enforced through state motor vehicle inspection laws.[200]

Legal and administrative arrangements

As indicated by the previous review of environmental legislation, one of the major problems that the present pattern of rule making and enforcement in environmental law presents to effective environmental management is the lack of a unified policy and the disjunctiveness of regulatory and enforcement activities. This lack of integration and disjunctiveness is two-fold. First, there is no integrative principle that in some way ties federal and state development programs into the state and federal environmental control effort. Second, present legislation too often separates the responsibility for rule making and standard setting from the responsibility for enforcement by lodging them at different levels of government. Although there may be adequate reasons for the division of labor, it frequently renders the regulatory effort less effective.

The earlier portion of this paper dealt primarily with specific regulatory efforts in the control of pollution. But, when discussing the lack of integration of policy between development programs and the programs of pollution control, we must consider governmental involvement more broadly. So, for instance, the federal and state highway program has a most significant environmental impact which heretofore either has been disregarded or dealt with in a manner wholly separate and unrelated to programs to regulate environmental pollution. The highway program—aside from possible damage to scenic, historic and aesthetic values—has major ecologic effects in that it may interfere with watershed management, and may adversely affect forests, wildlife and other resources deserving of protection. Just as important as any of these, it may have a major impact on the spread of air pollution from automotive sources. The federal government's support of extensive roadbuilding programs [201] constitutes federal support for internal combustion engines, by encouraging greater use of private automobiles and refined fuels, and in consequence, of automotive air pollution and other environmental effects that stem from fuel refining operations. The production of more automobiles in and of itself makes considerable demands on power resources which in turn require industrial and combustion processes with broad environmental implications. Without entering into any detailed discussion of the social and economic implications of federal road building programs, and even on the basis of a very cursory overview, it is apparent that to consider federal regulatory activities that deal with air pollution, water pollution, and other major environmental pollutants without reference to the federal government's own activities that have a direct or indirect impact on the environment is to tell less than the full story. Thus, federal controls on automotive pollution may be largely neutralized. The present policy preference for roadbuilding over development of means of mass transportation is, thus, a policy which has to be considered as part of the air pollution control picture, as well as, of course, a matter having huge planning, land use, and urban developmental implications.

As to the second aspect of disjunctiveness in environmental policies and programs, it is clear that the dispersal of responsibility among federal, state and local agencies frequently creates confusion and results in ineffective enforcement. A review of the situation in the field of air pollution control provides a focus for discussion. While clearly air pollution is a regional problem in its impact and actual standard setting functions is moving toward the federal government, all of the effective regulatory controls remain lodged on the local level.[202] The federal government still is responsible only for approving regional air quality standards (except in the case of emissions from new automobiles where some federal emission standards have been set). While all of the states have by now enacted state air pollution control codes that set limits on the emission of air pollutants in order to live up to federal standards for the ambient air, it is clear that no fixed formula determines the relationship of emission standards to ambient air quality standards, and the presence of federal air quality standards does not by itself impose upon any state the obligation to reduce emissions from particular sources. Legislative developments already point to the eventual adoption of federal emission standards, possibly national and most certainly regional in scope. But even with adequate federal and state emission standards, enforcement is likely to remain at the municipal level. As pointed out earlier, enforcement is limited by the geographical boundaries of the jurisdiction. Since effective air pollution control must make place at the source of emissions, the jurisdiction which receives the fallout and which suffers the consequences of the emissions is frequently not the one which can regulate the source. In view of the fact that most municipal or other local enforcement agencies operate independently of the state air pollution control agency, enforcement is likely to be very spotty indeed. Moreover, though the standards may be relatively high, having been set at the state level, enforcement at the local level may reflect a response to political pressures which were not present to the same extent at the level at which the policies were first adopted. Thus, though the federal government or the state may limit particular emissions stringently, local enforcement is likely to be lagging when the enforcement efforts would result in limiting the activities of a major employer in the locality.

Present arrangements for policymaking are thus in need of substantial review with a view to restructuring environmental programs on a national or at least regional level. Enforcement activities are similarly in need of review. Traditionally, much of the environmental enforcement effort has been lodged at the local level. Recently legislative developments have begun to place policy-making and standard-setting at higher levels of government, reflecting the insight that effective standards and policies for environmental control cannot be limited within narrow jurisdictional boundaries. The question arises whether what is true of policy-making and standard-setting is not also true of enforcement. Can we rely on the local jurisdiction to enforce the state, regional or national standard if the impact of stringent enforcement will fall primarily on industrial and commercial establishments within the local municipality? While a national air pollution control program would be difficult to operate with thousands of air pollution control inspectors and other enforcement personnel responsible to the National Air Pollution Control Administration in Washington, D.C., new instrumentalities and new enforcement devices should be considered to overcome the constraints that local administration puts on effective enforcement.

A major part of the difficulties in the regulation of environmental pollution is posed by the persistent attempt to deal with regional and national problems on a state or local level, in spite of the fact that is very recent, and our traditional institutions and modes of dealing with it reflect a cultural lag. It is important to remember that less than ten years ago air pollution could still be regarded as a primarily local problem, and that it has been a mere fifteen years since the federal government has involved itself in the regulation of water pollution. Originally the dimension of these problems whas such that they could be regarded as local in nature, but air pollution and water pollution are no longer local or even state problems; they have become national problems quite simply because the amount of pollution and the adverse environmental effects have become so great as to burst beyond the boundaries of narrow local jurisdictions. They have simply become too great for municipalities and states to handle on their own. The process is still going on—initially local problems still grow into matters of national concern in environmental pollution. The solid waste disposal problem is an example. Still treated as a primarily local matter, it is becoming more apparent every day that no major municipality has enough land to bury its waste or the facilities to incinerate it would creating major water or air pollution problems that will spill over municipal—and state—boundary lines.

The persistence of the belief that problems of environmental pollution that are regional and national in their impact can somehow be handled on the local or municipal level continues to have adverse consequences on the effectiveness of regulation. It has been demonstrated that the territorial jurisdiction of many municipalities and local governments and even the territorial jurisdiction of many states—is inadequate to cope with problems of regional air or water pollution. Within metropolitan areas, in particular, the source of emission and the place of fallout are likely to be under different governments. Since local governments have no extraterritorial powers and since state governments rarely intervene in local intergovernmental disputes—particularly where the dispute has its origins in the activities of a private operator—there is frequently no agency that is responsible for abatement. What holds true of different municipalities within one metropolitan area also holds true of interstate regions. When the source of emissions is in one state and the impact is in another, the only available remedies are either federal or else, far less frequently, remedies provided under some interstate compact. The only other remedy, an original suit in the United States Supreme Court is even less frequently invoked.[293] Thus far the federal government has exercised its enforcement powers with great restraint—rarely, and only after lengthy delays, and in emergency situations.

In addition to weaknesses in enforcement caused by limited territorial jurisdiction, disabilities have also been caused by inadequate legal power. This is particularly true of powers granted to local and municipal governments. The powers of municipal government under state constitutional or state legislative provisions are often narrowly circumscribed.[294] Even in instances where a municipality has been granted home rule status, the question whether it may carry out particular functions is often unclear, especially when the state has already asserted a regulatory interest by enacting general legislation.[295] Assuming that the municipality's power to exercise a power on its own is clear, the question of consistency of the local and state code still remains, and unless the local code merely duplicates the state code, there will always be a question whether a different regulatory approach is consistent or inconsistent with the state regulations. When the state merely regulates emissions may the municipality add fuel regulations, or would such fuel regulations be considered inconsistent with the state action? There simply is no clear answer.

Problems of consistency aside, local governments are commonly granted more limited powers of enforcement than state governments. Most of the state codes are presently enforceable by a variety of criminal and civil (including administrative and equitable) sanctions. On the local level, however, enforcement is likely to be by criminal prosecution as for misdemeanor, and the use of civil penalties or equity proceedings is either not authorized at all, or else is only rarely invoked. The limits of the criminal process for effective environmental enforcement have been discussed elsewhere.[296] In view of the relative ineffectiveness of the criminal process to bring about improvements or abatement of conditions, a municipality that can do no more than to prosecute an environmental offender is severely handicapped in its efforts.

In a few areas the federal government has seized hold with full vigor and has claimed preemptive effect for its laws and regulations. While federal preemption may be necessary in some areas, it may also create problems of its own, as, for example, in the area of control of airplane noise and atomic energy. Essentially, federal preemption has tended to create a jurisdictional no man's land where state and localities fear to tread though full regulatory jurisdiction has not been expressly exercised. Federal preemption, both with respect to regulation and enforcement, is clearly called for in many areas of environmental control—when national uniformity is essential by the nature of the problem, or the consideration of regulatory efficiency proves persuasive. The argument for federal preemption, however, need to be examined and clearly articulated in every instance. When a decision is made to use federal power preemptively, it should be made wholeheartedly, to cover the field clearly and decisively in order to avoid the peripheral jurisdictional uncertainties.

The federal government could, constitutionally, assume control of the regulation of all environmental pollution, and it could establish broad interstate regions to carry out its regulatory activities, but it is unlikely to do so both for political reasons and for reasons of administrative economy. Short of such federal assumption of power, the only viable mechanism for regional pollution control management is the interstate compact. Although the interstate compact has not been used to full effect in the regulation of environmental pollution, it appears to be an instrument of considerable flexibility and potential. There are a number of problems with the interstate compact device which will need to be resolved, however, before its full potential may be realized. Considerable attention should be given, first, to redefining the appropriate federal role in such an interstate arrangement. With the dominant federal interest in navigable waters (and, therefore, indirectly in all waters), interstate compacts affecting waterways have invariably had federal representatives, observers, or participants on the regulatory commission.[307] With the exception of the Delaware River Basin Compact, however, interstate compacts have not enjoyed direct federal participation, and the federal government has thus far not seen fit to exercise federal power through interstate compact agencies. The possibility that the federal government might well use interstate compact agencies as executors of federal policy was contemplated and accepted in the promulgation of the Delaware Compact.[308] In order to make the interstate compact device more effective and less likely to conflict with closely related federal interests, the possibility of working out similar relationships in other water pollution compacts, as well as in air pollution control compacts that have been proposed, ought to be considered.

Government structure for environmental management

In the planning for effective environmental control a question has been that of the appropriate level of government to make policies and rules and to carry out or enforce them. Brought down to its simplest terms, the question is how wide must a government's territorial jurisdiction be to operate effectively in the control of environmental pollution. To a considerable extent, the question is one in which administrative and legal arrangements ought to follow scientific and technological determinations relating to airsheds, watersheds, etc. Thus, while there is considerable agreement that local control of air pollution is no longer appropriate because the problem by now clearly exceeds local boundaries, there still remains a question as to whether the state, the region, or the nation as a whole is the appropriate regulatory entity.

For adequate pollution controls, a set of criteria ought to be developed to help determine the conditions which make uniform national or regional standards desirable or necessary. Enough experience has probably been collected in the regulation of air and water pollution to make such criteria possible. Such a set of criteria would then be properly applicable to the planning of mechanisms for the control of other pollutants as well. Thus, the problem of solid waste disposal is clearly emerging from a local and state issue into a national one. The nice question which has to be answered before long is, when is the lack of a local solution to a problem so fraught with regional and national consequences that it properly becomes a regional or national concern? Some developments that invite comparison are taking place in noise pollution control. Because the jet plane—which has brought about the demand for noise controls—is clearly in interstate commerce, federal controls have been developed. In the case of muffler legislation for automobiles—though the automobile is involved in interstate commerce no less than the jet airplane—reliance has been placed on state legislation.[29*] Muffler legislation is more effectively enforced as part of state motor vehicle inspection programs, but the need for national uniformity in the case of automobile mufflers may be no less great than the need for uniform standards affecting jet engines.

In all of these instances the problem is two-fold. The issue is not only what level of government should appropriately regulate the problem, but whether policy making and standard setting functions need to be the responsibility of the same level of government that is primarily responsible for enforcement. Thus far these issues have been resolved pragmatically. Since state and local governments were historically concerned with the environment in the traditional exercise of the police power, and since state and local governments, in consequence, were the ones that had staffs of inspectors, sanitarians and other enforcement personnel, enforcement has generally been lodged at the state and local level,[30*] although policy making and standard setting has begun to move in the direction of higher levels of government. Thus, though regional air quality standards may be approved by the federal government, the emission controls—if enforced at all—are enforced by the local air pollution control officer. Whether policy and rule making, and enforcement should be divorced in this manner ought to be examined systematically. While the enlargement of federal enforcement machinery is generally looked upon with distrust, if not hostility, the question whether federal standard setting should not, in due course, lead to greater federal involvement in enforcement activities might well be explored. At the very least, devices must be found to prevent narrow local interests from determining the direction and rigor of the enforcement effort.

Notes for Paper 1 *

*See original source for complete footnote refernces.

[2] Jacobson c. Massachusetts, 197 U.S. 11, 25 (1904); Town of Shelby v. Cleveland Mill and Power Co., 155 N.C. 196, 200, 71 S.E. 218, 220 (1911); Berman v. Parker, 348 U.S. 26 (1954).

[3] U.S. v. Carolene Products Co., 304 U.S. 144 (1938); Speert v. Morgenthau, 116 F.2d 301 (D.C. Cir. 1940); U.S. v. Patterson, 155 F. Supp. 669 (N.D. 111, 1957).

[4] Ch. 758, 62 Stat. 1155 (1948).

[5] Hines, *Nor Any Drop to Drink: Public Regulation of Water Quality, Part III: The Federal Effort*, 52 IOWA L. REV. 799, 800 (1967).

[8] The Water Quality Control Act of 1965, Pub. L. No. 89-234, § 1(a), 79 Stat. 903 (1965), 33 U.S.C.A. 1153 *et seq.* (1970).

[13] S. REP. No. 389, 84th Cong., 1st Sess. 3 (1955).

[16] *See* NATIONAL CENTER FOR AIR POLLUTION CONTROL, U.S. PUBLIC HEALTH SERVICE, A DIGEST OF STATE AIR POLLUTION LAWS (1967).

[18] Motor Vehicle Air Pollution Control Act, Pub. L. No. 89-272, § 102 *et seq.*, 79 Stat. 992 (1965) (now 42 U.S.C. subch. 11 (Supp. V, 1965-69)).

[24] Emissions standards are now authorized by CAL. HEALTH AND SAFETY CODE §§ 39080 *et seq.* (West Supp. 1970).

[27] H.R. 17,199, 17,200, 17,393, 91st Cong., 2d Sess. (1970) (bills to amend the National Emission Standards Act and

to provide for elimination of automotive pollution).

[84] *Hearings on Air Pollution Compacts before the Subcomm. on Air and Water Pollution of the Senate Comm. on Public Works*, 90th Cong., 2d Sess. 459-66 (1968) [hereinafter cited as Hearings on Air Pollution Compacts].

[85] Pub. L. No. 91-190, 83 Stat. 852 (1970).

[86] Halliday, *A Historical Review of Atmospheric Pollution*, in AIR POLLUTION 13, 14 (World Health Organization 1961); CHARLESWORTH, LIABILITY FOR DANGEROUS THINGS 130, 140-42 (1922).

[87] E. W. GARRETT, THE LAW OF NUISANCES 125, 135 (3rd ed. 1908).

[88] COUNCIL OF STATE GOVERNMENTS, SUGGESTED STATE LEGISLATION PROGRAM FOR AIR POLLUTION CONTROL 42-3 (1958); *see also id.*, at 132 (1959).

[89] Pub. L. No. 90-148, 81 Stat. 485 (1967), 42 U.S.C. § 1857 *et seq.* (Supp. V, 1965-69).

[54] Council of State Governments, State Air Pollution Control Act, 26 SUGGESTED STATE LEGISLATION A3 (1967).

[55] *E.g.*, Stamford, Conn., Ordinance No. 21, June 15, 1950; WILMINGTON, DELA., CITY CODE §§ 312-315.

[56] *E.g.*, Fulton County, Ga., Board of Health Reg. No. 2, January 17, 1952.

[57] *E.g.*, St. Paul, Minn., Ordinance No. 9275, May 10, 1949.

[58] *E.g.*, Birmingham, Mich., Ordinance No. 450, April 5, 1954.

[59] *E.g.*, MIAMI BEACH, FLA., CITY CODE §§ 22.68-22.68.9 (1958).

[60] *E.g.*, AIR POLLUTION CONTROL DIST. OF LOS ANGELES COUNTY, RULES AND REGS., Reg. II, Rules 10-14, 17-25, Reg. III, Rules 40, 42-44; CHICAGO, ILL., MUNIC. CODE, ch. 17, May 1, 1959.

[61] Hutchins, *Background and Modern Developments in Water Law in the United States*, 2 NAT'L. RES. J. 416, 422 (1962); Stein, *Problems and Programs in Water Pollution*, *Id.*, at 388, 404 (1962).

[68] This ad hoc delegation of regulatory powers to presently existing state agencies is illustrated in Carmichael, *Forty Years of Water Pollution Control in Wisconsin*, 1967 WISC. L. REV. 350, 352-59.

[73] TEX. REV. CIV. STAT. ANN. art. 7621d-1, § 3.14 (Supp. 1969).

[83] Comment, *Water Pollution Control in New York* 31 Albany L. REV. 50, 60 (1967).

[91] Bower, *Some Physical, Technical, and Economic Characteristics of Water and Water Resource Systems*, 3 NATURAL RES. J. 215, 219 (1963).

[93] Such a grant may be broad indeed. In Application of City of Johnstown, 12 App. Div., 209 N.Y. S 2d 982 (1961), the "waters of the state" were held to include all fresh water in streams, public or private, even though non-navigable.

[97] PRESIDENT'S SCIENCE ADVISORY COMMITTEE (ENVIRONMENTAL POLLUTION PANEL). RESTORING THE QUALITY OF OUR ENVIRONMENT (1965).

[99] N.Y. PUBLIC HEALTH LAW § 1205(3) (McKinney Supp. 1969).

[100] City of Utica v. Water Pollution Control Board, 5 N.Y.2d 164, 156 N.E. 2d 301, 182 N.Y. S.2d 584 (1959).

[101] City of Huntington v. State Water Committee, 137 W.Va. 786, 73 S.E.2d 833 (1953) (due process); Madison Metropolitan Sewerage District v. Committee on Water Pollution *et al.*, 260 Wis. 229 50 N.W.2d 424 (1951) (equal protection).

[103] State Board of Health v. City of Greenville, 86 Ohio St. 1, 98 N.E. 1019 (1912); Board of Purification of Waters v. Town of Bristol, 51 R.I. 243, 153 A. 879 (1931).

[106] *E.g.*, N.Y. MUNICIPAL HOME RULE LAW §§ 10, 36, 37 (McKinney 1969); 1 NEW YORK CITY CHAPTER AND ADMINISTRATIVE CODE § 751 *et seq.* (Supp. 1969-70).

[113] N.Y. Times, June 4, 1969, at 34 col. 2.

[116] For a tabulation of these laws, see Kaufman, *Control of Noise Through Laws and Regulations* in NOISE AS A PUBLIC HAZARD 340 (Proceedings of the Conference of the American Speech and Hearing Association, Washington, D.C., June 1968, 1969).

[118] NEW YORK CITY CHARTER AND ADMINISTRATIVE CODE 435-5.0(a) (1963).

[120] CODE OF GENERAL ORDINANCES OF CITY OF PHILADELPHIA §§ 10-(401-408) (1956).

[121] MUNICIPAL CODE OF CHICAGO § 99-58 (1969).

[123] N.Y. MULTIPLE DWELLING LAW § 84 (McKinney Supp. 1969-70); 4 NEW YORK CITY CHARTER AND ADMINISTRATIVE CODE RS12-(2-4) (1963).

[134] NEW JERSEY REGS. FOR THE CONSTRUCTION AND MAINT. OF HOTELS AND MULT. DWELLINGS, art. 18, July 19, 1967. Issued pursuant to ch. 76 LAWS OF NEW JERSEY (1967).

[135] 81 Stat. 490 (1967), 42 U.S.C. § 1857(d)(1)(A) (Supp. V, 1965-69).

[136] It has been suggested that this informal procedure is a necessary result of the nature of the conference. It is basically a meeting of all the governmental agencies involved to consider a problem of concern in the light of all the information available in order to arrive at the remedial action necessary. Edelman, *Air Pollution Abatement Procedure Under the Clean Air Act,* 1 ARIZ. L. REV. 30, 32 (1968).

[139] U.S. v. Bishop Processing Co., 287 F. Supp. 624, 633 (D.C. Md. 1968), *aff'd,* 423 F.2d 469 (4th Cir. 1970), *cert. denied,* 398 U.S. 904 (1970).

[143] 81 Stat. 496 (1967), 42 U.S.C. 1857d (h) (Supp. V, 1965-69).

[145] The history of the case can be found in 423 E.2d 469, 470 (4th Cir. 1970). *Cert.* was denied in 398 U.S. 904 (1970).

[146] 80 Stat. 1250 (1966), 33 U.S.C.A. §§ 1160(a), (d) (1) (1970).

[150] Allegheny Airlines v. Village of Cedarhurst, 132 F. Supp. 871 (E.D.N.Y. 1955), aff'd 238 F.2d 812 (2d Cir. 1956); American Airlines Inc. v. Town of Hempstead, 272 F. Supp. 226 (E.D.N.Y. 1967), aff'd, 398 F.2d 369 (1968) (holding village ordinances explecitly and implicitly barring aircraft from lower air, in an effort to decrease aircraft noise, invalid as conflicting with federal law in an area of federal preemption); 34 Fed. Reg. 18356 (1969) in which FAA posits support of local controls stating "The judicial decisions and legislative history of Public Law 90-411 [the Noise Abatement Act] have made it clear that the Federal Government should not substitute its judgment for that of the airport operator's right to issue regulations or establish requirements as to the permissible level of noise which can be created by aircraft using the airport."

[154] 34 Fed. Reg. 18355 (1969) sets forth a summary of public comments generally concluding that standards should be changed

[156] ". . . the uncertain limits of municipal power have had a stultifying effect on local initiative. Since local officials must consider whether a prospective ordinance might fall outside the area of 'property affairs, or government,' [many will] be restrained in exercising their lawmaking functions." Note, *Home Rule and the New York Constitution,* 66 COLUM. L. REV. 1145, 1154 (1966).

[158] F. Grad, *The State's Capacity to Respond to Urban Problems: The State Constitution* in THE AMERICAN ASSEMBLY, THE STATES AND THE URBAN CRISIS at 46, 47 (A. Campbell ed. 1970).

[160] N.Y. PUBLIC HEALTH LAW § 1242(7) (McKinney Supp. 1969).

[161] State Board of Health v. City of Greenville, 86 Ohio St. 1, 98 N.E. 1019 (1912); Board of Purification of Waters v. Town of Bristol, 51 R.I. 243, 153 A. 879 (1931).

[204] "The state governments' attitude toward pollution control parallels that of the Federal Government profusion of conflicting state agencies dealing with these problems is common. Even more common are the lack of effective power and the minuscule budgets." A. Reitze, Jr., *supra* note 63, at 926.

[205] See, *e.g.,* New Jersey, v. New York, 283 U.S. 805 (1931), modified 347 U.S. 995 (1954).

[206] E. Rusco, Municipal Home Rule: Guidelines for Idaho 38 *et seq.* (Bureau of Public Affairs Research, University of Idaho, Res. Mem. No. 1 (1960).

VII.2 State responsibility in managing the environment

Dan W. Lufkin *

The phoIosophy of the new federalism that we now espouse in terms of revenue sharing and financial talk, has to extend to delegating authority and responsibility to the state level, with overview and assistance clearly coming from the regional level. Management by exception by the federal government is the rule of the day, rather than management by attention to every little detail. It is not only absolutely crazy, but impossible for the federal government to make all of our decisions for us. We have 16,000 point sources of air pollution in Connecticut alone, just for starters.

Peter Drucker, always one of the most direct and thoughtful writers about business (and we are in a business, and this is true of bureaucrats as well, myself included), says that by and large, all businessmen spend ninety percent of their time concentrating on problems, and ten percent of their time concentrating on opportunities.

Where we really have a role to play, federal, regional, or state officials, is to concentrate on our opportunities. That role must be on the state level, the responsibility of enforcement; and on the federal and the regional level (this is split a bit), the setting of the goals, the putting in place of the standards, and the establishment of the objectives, penalties and rewards. But the individual state administrators and state organizations must be left to implement the program. When the state fails to do that job, then the federal government should get in there fast, and change the deck, both in terms of dollars supplied, and in terms of authorities exercised, from Washington. Speaking for Governor Meskill, there is nothing that I know of in the State of Connecticut (other than a junior edition of Watergate) that would agitate him more than having the federal government in his backyard and all the attendant publicity about his inability to handle the job. And that's the greatest incentive for the State to do the job.

There was an article in our main newspaper in Connecticut, the *Hartford Current*, about Russell Miller. Our main regional airport in Connecticut is Bradley Field. The article stated the following: "Russell Miller, an amateur naturalist who makes a living as an airport businessman, maintains that Bradley Field is one of the best wildlife sanctuaries in Connecticut. He would like to see the new organization of the State Department of Environmental Protection declare the area a sanctuary. 'Wild animals quickly get used to the sounds of aircraft taking off and landing. . . . These sounds may in fact increase wildlige population by keeping them awake and breeding instead of sleeping.' " You can get anything you want under the tent of environment! Many of us often try it!

The legislature and the governor of Connecticut established the Department of Environmental Protection, and took the pieces (we really followed the lead of the federal EPA) out of health, natural resources, and agriculture. We put air, water, solid waste, pesticides, radiation, and all of the natural resource capabilities of the state for recreation, forest, fish and game, parks, boat launching, and all of those activities, together in one department, and gave the department a broad mandate.

*** Presented by Dan W. Lufkin, Commissioner, Department of Environmental Protection, State of Connecticut, at the National Conference on Managing the Environment.**

Under Act 872 ,which established the department, there is so much authority that we really have not found it all yet. What is not there, we pretend is there.

We have the opportunity to do the job. Within that framework, some accomplishments have come forth, and they have come forth with the support, the encouragement, and even the prod of the regional EPA in Boston under John McGlennon. There is a solid waste program that, for the first time, establishes solid waste as a state authority. We set up an independent contractor, the General Electric Company, to examine the difficult issue for one year: how to attack solid waste on a regional basis, what are the types of technology, what are the costs of those technologies, where is resource recovery in harmony with the pocketbook, and so on. What has come out of that study is the solid waste authority bill, which establishes an independent authority in the state to manage and handle solid waste. General Electric developed a plan in conjunction with our state department, that sets up 23 wastesheds, separation of combustible and non-combustible material, and the re-use of those materials, at a cost of about $10. a ton. That is economically advantageous, if all costs are figured in the high density areas of Connecticut. There is also a bonding capacity of $250 million to the authority, with one interesting aspect—in the authority bill is the provision that, by law, there can never be more than thirty employees in that authority. There will probably never be more than fifteen. In that authority is a nine member board, and a $250 million independent bonding capability. The authority gives the incentive to the private business sector to perform efficiently on a profit making basis, creating, managing, innovating, bringing about change which is properly directed and properly incentived, and which is a role best performed by private industry.

Let government do what it is good at doing. That is establishing the policies, directing the roads to follow, and legislating into place the rewards and penalties.

One ability needed by the states is an administrative enforcement procedure, rather than a court enforcement procedure which would be used only by exception. What I am referring to is a series of administrative fines that equate the cost of compliance with the cost of non-compliance. The only thing we have now to get at a polluter in the State of Connecticut is two things: We can issue him an order, and go through all of the cumbersome and tortuous court procedures involved, or do noting. There is nothing in between. We issued a registration activity for the 16,000 point sources of air; twenty-five percent did not respond. They probable lost it, or maybe a minority dedecided that they were not going to respond. The only way that we can get back that questionnaire is to take the guy to court under order. That is crazy. What we have done in the legislation, which will be passed soon, is to set an enforcement procedure, an administrative fining capability. We measure the cost of compliance, the cost of operation, the cost of equipment, opportunity costs lost, the cost of capital, on and on, and equate with that the cost of non-compliance—legal fees, capital use saved by not being employed in that fashion, operating costs saved, fines that under the bill run, and ultimate costs discounted in terms of time of finally complying with the order. That is a big bill. So when you equate that, that is the cost of non-compliance. You equate your cost of compliance with that cost of non-compliance—the fine. It is a continuous, running fine, which does two things. One is that people recognize the extent to which it is just as economic to comply as it is not to comply. Secondly, it eliminates all but the most meritorious suits. The frivolous suit does not go, because the clock is running while the pollution is continuing. It really does bring an additional tool which is desperately needed to the state arsenal of getting the job done at the local and at the state level.

What Washington and what the region should be spending their time doing is giving the field the tools, the incentives, the dollar bills (where the taxing capacity or the financial base of the state will not support it). They should be giving all of the opportunity to the states to do the job. When the job *then* is not done, step in, lock, stock, and barrel, with funds and with enforcement at a Federal or regional level. This will be management by exception which the Federal government should strive for.

VII.3 How a regional organization assumes environmental responsibility

Frank T. Lamm *

Wise management of the environment requires commitment from the local, regional, state, and federal levels of government. The failure of any single level to do its part can negate or place in jeopardy the good work of all the rest. Since the regional organization is often the newest level of government or quasi-government, its role is often less clearly defined than that of older, more established levels. However, it can be shown that many of the important environmental management concerns can be effectively resolved at the regional level. It is, therefore, of paramount importance that regional organizations throughout the country define and assume the appropriate responsibilities that will enable them to provide effective management.

Regional organizations—variety

There is no single description of a regional organization that is accurate for all such agencies. Some are formally structured, as by specific state legislation, while others are organized by consensus of participating local units of government. Some have an elected body, while others consist of appointed persons. Some are omni-governmental, some merely have general planning and review responsibilities, and others may have responsibility only in a single functional area of concern. Some operate under specific legislative mandate, while others are more free to function in those areas chosen by their governing body. Some can count on ample funding and staff expertise, while others are severely constrained by these factors.

The political climate within which the individual regional organizations function can also vary. In some instances the state executive role is so strong and well defined regarding regional concerns that the responsibilities of the regional organization are drastically limited, while in other instances the regional organization may be stepping into a governmental vacuum where no such well defined state responsibility exists. Also, the amount of cooperation and coordination received from local units of government and citizens at large can vary greatly.

Within the seven-county, 3,000 square mile Metropolitan Area serving Minneapolis, Saint Paul and vicinity, the Metropolitan Council is the regional organization. Many features of the Council, such as governmental structure and legislative mandate, are not typical to regional organizations as a whole. However, many of the approaches used by the Council in planning and implementation of solutions of environmental problems can be applied to other regions.

Assuming environmental responsibility

Regardless of the ability of the regional organization to provide solutions, there are a myriad of environmental concerns which can and should be approached at the regional level. Whether or not the regional organization has specific legislative mandate, there are many opportunities for cooperation with the appropriate state

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* Presented by Frank T. Lamm, P.E., Director of Environmental Planning Metropolitan Council of the Twin Cities Area, at the National Conference on Manging the Environment.

natural resource or environmental protection organization, or local implementing organization in order to address these concerns. This is especially true in the case of a regional planning and review organization. such as a council of governments or a metropolitan council, where limited operational or monitoring responsibility may preclude direct access to appropriate legal and other implementing devices, as well as to specific federal or state funding sources. Such cooperation can result in effective planning and implementation assuring maximum consideration of regional concerns.

Important indications of environmental responsibility at the regional level include the designation of the organization by HUD as the area-wide planning organization with appropriate certifications, and designation of the organization as regional clearinghouse under Bureau of the Budget Circular A-95.

The Twin Cities Area Metropolitan Council has environmental responsibility in the separate areas of air quality, solid waste management, water pollution control, water resources, and protection and recreation open space. This paper briefly discusses some methods of assuming regional responsibility in each of these environmental areas. In some instances, the Council has acted in conformance with clearly defined federal or state legislation, while in other instances it has been necessary to establish roles of cooperation with other governmental agencies that have the specific legislative responsibility.

Air quality has important regional implications, especially in regard to area-wide comprehensive planning, since air quality standards and other regulations, combined with the statewide air quality implementation plan, may have a significant effect on the location of such facilities as major airports, highways, and industrial or commercial complexes. Air quality responsibility rests primarily with the state. In Minnesota, state legislation assigns that responsibility to the Minnesota Pollution Control Agency, which may delegate many powers to regional implementation organizations. Through administrative agreement, regional air quality planning and referrals concerning approval of permits for certain large facilities must be approved by the Metropolitan Council prior to action by the State PCA.

It is difficult for general planning organizations to receive funding for air quality planning from the Environmental Protection Agency. However, there are funds from other federal agencies, such as the Federal Highway Administration, Urban Mass Transit Administration, and Federal Aviation Administration, which may be available to appropriate regional agencies. The Twin Cities Metropolitan Council uses funds from these agencies and also cooperates with the Minnesota Pollution Control Agency in developing the metropolitan area's portion of the statewide implementation plan for air quality.

Solid waste management is another environmental concern where cooperation with state, regional, and local agencies can occur effectively. In 1969 the Minnesota legislature created the Solid Waste Management Act. Recommendation for such legislation came from private citizen groups, municipalities, counties, and state interests, and was based on Metropolitan Council studies, hearings, and advisory board deliberations. The act assigned certain planning and permit review responsibilities within the metropolitan area to the Minnesota Pollution Control Agency, the Metropolitan Council, and the metropolitan area counties. The Pollution Control Agency grants a state permit, subject to Council review, and monitors the sites. The Council develops a regional solid waste management plan, approves county plans if they conform to the Council plan, and reviews permit applications. The counties develop county plans and ordinances, issue local permits, and also inspect sites. This distribution of planning and review functions has operated very effectively over the past four years. In this area of concern, it is very difficult for a planning and review agency to directly receive EPA planning funds. However, it is possible to act as a subcontractor to the appropriate federal or regional operational agency. Metropolitan Council has received flow-through funding from MPCA for solid waste studies. Also, HUD does have authority to grant planning monies for solid waste management, although this is not one of the more widely used funding sources.

Water Pollution control has become the most widely publicized environmental concern. The idea of a regional agency planning the solution to the Twin Cities Metropolitan Area water pollution control problems was one of the reasons for creation of the Metropolitan Council in 1967. The Council immediately began a technical study of the existing sewerage system and present and future needs, which resulted in a recommendation to the 1969 legislature to create a single operating agency to be responsible to the Council for provision of adequate metropolitan sewage collection and disposal facilities. The Council, after a lengthy public hearing process, adopted a development guide section for water pollution control in the Metropolitan Area. That guide section, modified annually since 1970 by capital improvements programs, forms the basis of construction and operation of the metropolitan disposal system. The Minnesota Pollution Control Agency has agreed annually to accept the Council's capital improvements program and project priority list as the Metropolitan Area's portion of the state request for EPA construction funding. The Council has received a three year basin planning grant from EPA. With the grant, the Council has produced the interim Water Quality Management Plan for the Metropolitan Area and is preparing the "official" Water Quality Management Plan. Also, the Council is recognized as the area-wide planning organization by HUD.

Metropolitan Council water pollution control responsibility extends far beyond the planning and capital improvements programming processes. The Council also approves the annual operating budget of the Metropolitan Sewer Board and the allocation of metropolitan disposal system costs to municipalities. The Council provides A-95 review for federal funding purposes and, in addition, review of required local comprehensive sewer plans for conformance to the Council's development guide. This latter review takes place in cooperation with the review provided by the Metropolitan Sewer Board, which under the Metropolitan Sewer Act was given that responsibility.

The Council received substantial planning funding for water pollution control studies from HUD during the initial study years. From 1970 to early 1973 the Council had a three year basin planning grant awarded by EPA. It is true that the 1972 amendments to the Federal Water Pollution Control Act has caused EPA planning sources to be temporarily closed, but the Council does anticipate planning funds to be made available under the new amendments, under at least one of three sections of the act: 201, wherein through cooperation with the implementing agency (the Metropolitan Sewer Board) planning funds could be made available as a part of the construction grant; 208, where the Council would meet the test of an area-wide planning agency; or 303(e), through cooperation with the Minnesota Pollution Control Agency as part of the state-wide continuing planning process.

In the water resources area, efforts by the regional organization can result in a broadened respect for that organization throughout the regional area. Problems such as erosion, sedimentation, and flooding are prevalent in many parts of the nation. Coordination of water supply needs is also important, whether there is one single, limited source, or where there is a choice of a number of surface and groundwater sources. Adequacy of treatment, storage, and fire protection, variations in water rates, and provision of water supply on a multi-municipal basis are all subjects which may be considered. It is necessary to provide an area-wide plan for water supply and storm drainage in order to receive HUD certification.

The legislation creating the Council gave it planning responsibility in the area of water resources within the Twin Cities Metropolitan Area. Subsequent amendment of the state Watershed Act required watershed districts in the Metropolitan Area to submit their Overall Plans and Comprehensive Plans to the Council for review and approval.

The Council staff works closely with local, state, and federal water resource organizations. The U.S. Geological Survey provides data under cooperative agreements, including a three and one-half year study of water sources available to the area. Staff represent the Council and the Metropolitan Area on the State Water Resources Coordinating Committee and on the advisory board to the State Water Resource Reearch Center. Staff also represents the state on the Upper Mississippi River Basin Commission Level "B" study for the Metropolitan Area. The Council has participated in water resources studies of portions of the Metropolitan Area in cooperation with the State Department of Natural Resources and has jointly sponsored a seminar on watershed districts in cooperation with the Minnesota Association of Watershed Districts. Planning for most of the water resources effort has been supplemented by HUD funding throughout the life of the Council.

Protection and recreation open space are two natural resource considerations that are of great concern to the Council. There does not seem to be a well-coordinated effort in the area of open space protection assuring that our important or unique land resources will be properly managed and where necessary preserved or protected. Of particular importance are areas under immediate pressure for urban development. Regional organizations can provide a much-needed focal point to examine such issues. This is not easy to do, for many reasons. First, it is difficult and costly to document the importance and uniqueness of many land forms. Secondly, it is difficult and expensive to determine what proper protection or management steps are to be taken. Thirdly, it is difficult to persuade local units of government to consider protection elements in their zoning and land use ordinances.

The Council has adopted and revised its Open Space Development Guide. That guide has attempted, through policies, general system plan, and procedures to persuade local units of government to consider protection and management proposals. The difficult job of documenting those protection measures is now being initiated. The Council has been assigned a soil conservationist from the Soil Conservation Service under the Intergovernmental Cooperation Act to assist staff in developing the technical data.

In recreation open space the Council has concentrated on recommending the regional portions of a recreation system, along with appropriate policies. Council staff has cooperated with various public and private groups in the open space arena. Of particular note was the creation of an Open Space Advisory Board which developed the latest guide section and recommended legislation which is presently being considered by the Minnesota Legislature.

Summary

I have attempted to outline some of the methods by which regional organizations can assume environmental responsibility, using the Twin Cities Area Metropolitan Council as an example. Major methods of assuming responsibility or participating in the approval process can be summarized as follows:

> (1) Refer to the mandate of legislation which created the regional organization. Where the organization was not formed by legislation, incorporate such responsibility in the charter of the

organization or other document creating it. Legislate changes to the mandate when necessary.

(2) Receive designation as regional clearinghouse for A-95 review and for HUD certification purposes as the area-wide planning agency.

(3) Cooperate and coordinate with those organizations at other levels of government which have specific environmental responsibilities resulting from federal or state legislation. Where necessary, enter into contractual agreements or memos of understanding to provide the coordination.

(4) Cooperate with and be responsive to queries from the public at large. Often the effectiveness of the regional role in environmental management is directly related to the credibility of the regional organization in the eyes of the private citizen. Disseminate information to the widest extent feasible.

(5) Provide adequate staff and a continuous program of study, along with appropriate products, to assure contribution to the environmental concerns commensurate with your responsibilities. Make full use of federal, state, and other sources of funding.

(6) Be innovative in your thinking, and remember to address the governmental structure and fiscal measure best suited to provide the changes recommended.

VII.4 The triumphant technocrats and non-functioning federalism

David B. Walker *

Of the several challenges confronting the American federal system in the seventies, the least recognized and probably least understood is the growing gap between program specialists with their interest group and legislative allies and elected decision makers at all levels. Yet, in the long run, efforts to correct the fiscal crisis, to bring greater order to the jurisdictional jungle in our urban areas, to cut through the tangled web of intergovernmental administrative relations, and to improve service delivery systems will fail unless we see the vital connection between these challenges and the need to curb the growing power of specialized program functionaries at the three traditional levels, as well as at new, intermediate levels where neither the electorate nor elected officials operate directly.

The genesis of the gap

How then did this gap between technocrats and political executives, between "program politics" and "electoral politics," emerge? In one sense, it is as old as our governmental system with its geographic division of powers, three separate branches, checks and balances, and internal legislative and administrative structure organized by function and is as traditional as our political system with all of its decentralized, comparatively undisciplined, ambiguously programmatic, and easy-access features. In another sense, it is rooted in the myth, which many have accepted as fact, that policy decisions and policy execution are two clearly separate governmental activities with entirely different sets of actors performing in the arenas. In a more contemporary sense, the gap stems from the public's—particularly the mushrooming urban public's—ever-increasing demand over the past quarter of a century for more and better, and in several instances, highly specialized, services and from the governmental response to these demands.

And what a response it has been. Total governmental expenditures multiplied more than six times between 1948 and 1970, surpassing the $333 billion level. Outlays in the civilian-domestic sector (excluding the insurance trust) rose from $36 billion in 1948 to over $200 billion by 1970. Overall governmental receipts quintupled between 1946 and 1970 (reaching $333 billion) while governmental indebtedness soared by more than 80%. In addition, the number of public employees more than doubled during the same period and the professional sector reached the point where it represented about one-third of the total.

But what has this rapid acceleration in governmental activity meant in terms of our federal system and the relationship between officials and program administrators? In general terms, State and local efforts have been greater than those of the Federal government, although Federal incentives and initiatives have helped generate much of the activity at the other levels. The State and local share of all revenues rose from 25% to over 38% between 1946 and 1969; their share of all domestic program expenditures passed the 70% level and their employees expanded by

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*David B. Walker is Assistant Director of the Advisory Commission on Intergovernmental Relations. This article was excerpted from a speech delivered before the League of Minnesota Municipalities' Annual Convention, June 14, 1972.

more than 160% during the same period. By way of contrast, the Federal proportion of total civil governmental outlays actually declined from 43.7% to less than 30% between 1948 and 1970; its indebtedness rose by 470%; and its personnel rolls grew by only approximately one-half million.

The special role of grants

At the same time, Federal aid increased nearly 20 times during the period 1948-1972 and the number of grants soared from approximately 34 at the end of 1947 to an estimated 530 today. The bulk of this increase came in the sixties when nearly 200 new grant programs were enacted in the three year period 1964-1966 alone.

More than any other single factor, it has been this near explosion in the number, dollar amounts, and types of Federal grants that created the intergovernmental system we know today. It was this Federal response to the public's demands for better, expanded, or new services that laid one of the basic foundations of the present imbalance between the power position of the program specialists and that of political leaders and their generalist allies.

Now certain positive aspects of this development should be noted:

—It was after all largely a response to real constituent demands and needs with the frequent support of elected officials and administrators from the State and local levels.

—It did hike the Federal contribution to State and local revenues from 10.4% in 1948 to over 20% in 1971.

—During the sixties, the grant system did experience a marked shift to urban problems and programs, with funds earmarked for these areas increasing by 258%.

—Its programs in the human resources area rose from 47% of 1960 total to an expected 55% for 1973, while those in the transportation and commerce fields dropped from 43% to 14% during the same period.

—To a greater degree than State aid, it did aid central cities more than suburbs; seventy of the central cities in the 72 largest metropolitan areas in 1970 did receive proportionately higher per capita Federal aid than did their suburbs in 1970.

—Above all, this heavy reliance on categorical grants to provide fiscal aid and to achieve various national domestic goals was essentially a traditional response; the grant device after all has been the chief means used by the national government to achieve such objectives for well over three score years.

Not to be overlooked in all this is the nearly as strong emphasis on categorical aid at the State level. While less narrow in scope than most Federal grants and growing in size every year, State aid to localities overall has been and still is largely conditional in nature. In 1970, for example, all but $2.9 billion, or only a little over one-tenth, of the $28 billion in total State aid fell in the general support—with few strings attached—category.

The force of the functionalists

These are but some of the more prominent fall-out problems generated by the growth of grants in the sixties. But one of the biggest is less visible, though nonetheless vibrant and real. Sometimes, it *is* described clinically as the rise of "functional government;" sometimes in historical terms, as the emergence of the "new feudalists" or as the "growth of the guilds;" and sometimes in more pungent terms, like the "vertical, functional autocracies." And recently, a noted political scientist, in effect, described this phenomenon as the end product, if not the bankruptcy, of "interest group liberalism."

Despite the differences in these descriptions, each of them tells us something of the nature of this basic challenge. It *is* primarily a functional phenomenon, rooted in the recent heavy expansion of specialized governmental activity at all levels. It *does* resemble certain features of the feudal system of the middle ages, wherein the ostensibly subordinate components of that system —the dukes, earls and barons—frequently possessed a far greater power than their monarch. It *does* take on some of the character of the old guild system, in that specialization, shared professional or technical goals, and common program objectives are the basic behavorial conditioners that give each of these functional groupings its essential unity and provides the basis for its opposition to outside interference. It *does* involve a vertical relationship, since the membership of each guild is drawn from all levels of government; and these groupings do appear autocratic to some, given their perennial resistance to genuine oversight by politically accountable officials and their near monopoly on the professional and technical skills required to perform much needed, but complex, governmental functions. Finally, there *is* a strong interest group overtone to the composition and strategies of these functional conglomerates; each of them, after all, is really a coalition of administrators, outside pressure group representatives, and legislative proponents within the pertinent standing committees. Whether this phenomenon is a product of American liberalism as it has evolved over the past four decades, is a question I will leave to the political theorists, historians, and politicians. Having said this, it does no harm to note that pressure group politics have been with us as long as we have had political parties and political conservatives as well as political liberals have been known to support individual grant programs, specific governmental departments and agencies, and certain interest groups.

The tenets of the technocrats

Seven years ago, the United States Senate Subcommittee on Intergovernmental Relations issued a report entitled "The Federal System as Seen by Federal Aid Officials." The findings of this study, based on the responses of over 100 middle management Federal grant officials, highlight the fundamental views of all the defenders of functional government regardless of the level at which they operate. Four basic attitudes emerged from their survey responses:

- —Functionalism, or a preoccupation with protecting and promoting the purposes of their programs, was the dominant factor explaining their replies to the various questions posed.
- —Professionalism, or a deep commitment to the merit system and to the technical and ethical standards of their specialized group, was nearly as significant.
- —Standpattism, or a rigid defense of traditional practices, procedures, and principles, was also a major theme.
- —And indifference, or the cavalier dismissal of various critical intergovernmental issues as being irrelevant or unimportant, was the fourth attitude reflected in their responses.

Middle management executives, with a strong functional, professional, and status-quo orientation, are not likely to approach broad questions of a multifunctional, interlevel, intraagency, or coordinating nature with any great enthusiasm or concern. But this attitude also relates to other factors. It stems in part from the ignorance that only the narrow specialist can display toward broader questions of management, policy, and governmental operations. In part it comes from an acute awareness that their expertise is needed and that their administrative positions are fairly secure. Second, they recognize that many of the larger intergovernmental questions can only be resolved by others more directly involved in the decision-making process at the Federal, State, and local levels. And it also is rooted in their own particular view of the system and of where the tension points are located.

These program specialists identified three major sources of conflict in contemporary intergovernmental relations;

(1) Greater professionalism at higher levels versus a lesser degree of professionalism at the other levels; (2) Professional program administrators versus elected policy makers at all levels; and (3) Administrators of individual aid programs versus intergovernmental reformers.

This listing of tension points can not be ignored, since it underscores some fundamental antagonisms within our federal system that must be ameliorated, or at least curbed, if any of the other basic imbalances in the system are to be overcome.

The response of the generalists

Now much has occurred since 1965 that suggests that elected decision makers and top management at all levels, as well as those deeply concerned with achieving a more workable and responsive system, have not been unaware of this challenge. Witness:

—The Intergovernmental Cooperation Act of 1968, which strengthens elected officials and improves the chances for better Federal-State-local administrative collaboration;
—Reorganization Plan No. 2 of 1970, which hopefully will strengthen the domestic policy formulation and management controls of the Presidency;
—The Legislative Reorganization Act of 1970, which provides new tools for legislative oversight and fiscal control;
—The 1969 reorganization of the Federal field offices;
—The Intergovernmental Personnel Act of 1970, which seeks to upgrade the core management sector at the State and local levels;
—The positive 1970 and 1971 actions in Georgia, Illinois, Kansas, Maryland, and North Carolina, which bring to 12 the number of States providing the governor with executive reorganization authority subject to a legislative veto;
—Legislative action during the past seven years achieving major or substantial executive branch reorganization in a dozen States;
—Annual legislative sessions, now in over two-thirds of the States;
—A decrease in the number of standing committees in 23 States and an increase in professional legislative staff in 39 during the past two years;
—More than 200 counties with appointed administrators and nearly 40 with elected county executives;
—A significant increase (103) over the last decade in the number of cities (236) have planning agencies responsible to the mayor; and
—Adoption by nearly half the cities over 50,000 in size of some elements of a program, planning, budgeting system.

"The beat goes on"

Despite these encouraging actions, other developments provide the basis for continuing pessimism. They all underscore the enduring strength of the functionalists and their skills in perfecting old—as well as developing new—ways of preserving their strategic position of influence at all of the three traditional levels of government as well as at the new emerging ones.

At the Federal level, a number of developments should be noted, especially those relating to grant consolidation and block grants. Many believed that the passage of the Partnership in Health Act of 1966 might inaugurate a trend toward consolidation of narrowly defined categorical programs. Beginning with a consolidation of 17 previously separate categories and with significant discretion given to States and their governors in developing locally relevant State plans, three new categories were tacked on in 1968 and in December 1970 the President signed the Communicable Diseases Act which added a half dozen or more additional strings to the original measure. Meanwhile, reports from the field indicate that many governors have given their health administrators primary control over the program and comprehensive health planning units have been established at the substate regional level—usually separate and rarely having much to do with other areawide bodies. In short, the categories and the functionalists seem to be winning out again.

Another apparent breakthrough for the block grant approach was the Safe Streets Act of 1968. Here consolidation was not so much an issue in the debate over the original measure, since only a minor Federal program in this area existed at the time. What was at stake was the issue of achieving a block grant at the outset, rather than a mix of categorical grants of both the formula-based and project variety. In its 1970 study of this measure, the Advisory Commission on Intergovernmental Relations (ACIR) endorsed the block grant approach contained in the original legislation. No other area perhaps lends itself so well to this form of assistance. The interfunctional, interlevel, and interbranch problems associated with police, prosecution, corrections, and courts at the State and local levels are so complex, yet so connected, that no other approach, in our opinion, would make any sense. Yet, with a block grant there goes the burden of free choice, of making critical decisions, of using the discretion that is assigned. And this rests with the State Planning Agencies (SPAs) under the Act. As a mechanism for bridging the many gaps in the non-systems that exist in most States, the SPAs must be representative of functionalists and generalists, of State and local top executives, of legislative and judicial as well as executive branch people. They must have strong balanced consideration to the needs of all components of the system and to areas that suffer from severe crime problems. This is an arduous assignment and the evidence suggests that some have found it too tough. In reaction to much of this, Congress in 1970 adopted a number of amendments to the Act. Twenty percent of the action funds now are earmarked for corrections and the States are obligated to "buy-into" the program insofar as the non-Federal matching for local projects is concerned.

Efforts to secure mergers in the library services and construction field met with meager success in the last Congress (a reduction of five to four programs was achieved, rather than five to one, as was proposed). Moreover, the various consolidations proposed for the 1970 housing legislation merely produced mergers in the open space and research programs. Revisions of the Hill-Burton program resulted in an additional construction grant, rather than the merger of five programs into one, as HEW sought. Efforts to achieve a single authorization for the seven in the Medical Library Assistance Extension Act also failed in 1970.

With the advent of the special revenue proposals in 1971 came a much bolder and far more encompassing approach to grant consolidation but one which still relied on the workings of the normal legislative process. Special revenue sharing emerged as part of the broader revenue sharing goal stressed in President Nixon's 1971 State of the Union Message. Ostensibly geared to complementing the proposed reorganization of the executive branch as well as general revenue sharing, the six special revenue sharing measures would consolidate some 129 categorical grants into six broad programs. They would provide automatic distribution of most of the funds, minimal administrative strings, no matching or maintenance of effort requirements, adherence to Federal civil rights and labor standards, a discretionary fund for each of the Federal administrators, and "hold harmless" provisions to insure that no jurisdiction receives less under the new program than it did under the previous ones during a stipulated base period. Despite these common features, the proposals differed from one another in certain respects with many of the distinctive features reflecting the special problems of each program area. By the end of 1971, only three of the special revenue sharing measures—education, manpower, and urban development—

had been exposed to Senate hearings by the pertinent subcommittees. In the House, hearings had been held on only one—urban development.

Among the reasons for this slow pace were the comparatively late introduction of some of the special revenue sharing bills, the novelty of all of them, the absence of any real prior consultation with public interest groups and with the relevant Congressional committees, a heavy committee schedule in some instances, earlier Congressional action to the contrary as in the case of the 1970 Safe Streets amendments, and above all, concern over the fate of programs slated for consolidation or (particularly with the rural development proposal).

This brief chronicling of diverse consolidation efforts from 1966 through 1970 suggests that the need for merging narrow grant programs still is as great as ever. It indicates that the normal legislative course raises major hurdles of a political and program nature. It shows that even where a consolidation is temporarily successful, the tendency to recategorize is still strong, and that chief executives at the other levels must mount a vigorous initiative to curb the parochialism of their narrow program professionals if the discretion which comes to them from a block grant is to be retained. The record also suggests that broad, panoramic proposals that depart dramatically from the more usual consolidation approach are not likely to succeed.

With revenue sharing, the story, as of the moment, is almost as bleak.* But given the recent action of the Rules Committee, along with the concerted effort of elected policy makers from all levels, it seems likely that legislation in this area will be enacted before this Congress adjourns. Not to be overlooked here, however, has been the subtle but steady opposition of the individual program proponents, who view revenue sharing as a serious threat. Yet, revenue sharing will not succeed in strengthening the position of State and local elected decision makers and their core management allies, if these officials—by default or conscious design—permit the discretion it grants to slip into hands of middle management. In short, revenue sharing is no guarantee of stronger State and local leadership and management. In cases where this already is weak, it will simply amount to a rerouting of funds to line agency officials already aided under the categorical programs.

Regarding efforts to simplify and consolidate planning requirements under various categorical programs, much effort was expended by the Planning Assistance and Requirements Coordinating Committee. But no real results as yet are visible to the State, local, or neutral eye.

In the area of substate regional activities, two different strategies seem to be evolving: one for the generalists and the other for the program specialists.With the former, the A-95 process stemming from Section 204 of the Metropolitan Development Act of 1966 and the Intergovernmental Cooperation of 1968 stands out, since it basically benefits areawide bodies representative of general units of local government; and over 400 such units have been designated to perform the review and comment role under this clearinghouse procedure. With the program specialists, a different approach silently has been adopted, one geared to providing separate multi-jurisdictional mechanisms for various aided program activities. At latest count, there were:

—481 law enforcement and criminal justice planning regions;
—957 single and multicounty Community Action Agencies;
—419 substate CAMPS committees;
—129 regional comprehensive health planning agencies;
—115 Economic Development Districts;
—232 Air Quality Regions;
—50 Local Development Districts; and

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* General revenue sharing (The State and Local Fiscal Assistance Act) was signed into law on October 20, 1972.

—68 Resource Conservation Development Districts.

Now in some cases, the A-95 agency, has been utilized for some of these other federally encouraged areawide efforts. But findings of a 1970 survey indicate that only 21% of the 186 A-95 agencies polled were used for law enforcement planning; only nine percent for comprehensive health planning; only eight percent for economic development programs; only two percent for resource conservation; and only one percent for air quality control. It seems safe to say that the A-95's are having a very difficult time in absorbing or monitoring the efforts of these new breed of special districts in most metropolitan and some rural areas and this, in no small measure, relates to the strength and support that the program specialists continue to enjoy at the Federal and State levels. From the vantagepoint of local governmental policy makers, however, the specter of proliferating Federal-State mechanisms at the substate regional level should be some cause for alarm. Certainly, the resolution on this subject voted by the mayors at Hawaii in December of last year reflected some growing municipal concern.

In the State capitols, other developments underscore the resiliance of the functionalists at this level, including:

—Very few of the 12 recent State reorganizations did much by way of reducing the number of separately elected constitutional officials;

—Most of these executive branch reorganizations did not eliminate or seriously disturb the power of the more well established separate boards and commissions;

—The vast majority of the State planning efforts have not had an impact on the budgeting process or on the activities of line agencies and departments;

—Only a handful of State legislatures have a post-audit service comparable to that provided by the General Accounting Office to the Congress;

—Special districts, always a secure haven for program specialists, increased by more than 36 percent nationwide between 1962 and 1972, reaching the 24,942 mark; Minnesota enjoyed an 86 percent hike during this period;

—All but 7,580 of these nearly 25,000 special districts had boundaries that overlapped those of general units of local government and their total expenditure amounted to nearly $5 billion in 1967;

—This growth in special districts stems directly from either general or specially authorized State legislation, and no State has taken action to institute effective curbs on these authorities;

—Some 42 States have moved on the substate regional districting front, but in a majority of instances this has yet to affect the activities of State line agencies or Federal-State areawide program efforts.

An action agenda

These are but a few of the signs at the Federal and State levels that the "functionalists" are still the "wheel horses of the federal system." Where then does this leave us? It leaves us with elected decision makers who don't really decide, with top management that isn't on the top, with legislative oversight that rarely produces broad insight, and with an electoral process that has minimum impact on administration. It also leaves us with the program for intergovernmental reform that has been before us for some time. It includes:

—Revenue sharing, joint funding simplification, and the grant consolidation authority provided in the proposed Intergovernmental Cooperation Act of 1972;

—A continuation of Federal Assistance Review program at the Washington level;

—The development of a real Presidential presence in the Federal Regional Councils;

—An effective melding of State budgeting and planning efforts;

—More effective legislative oversight at all levels and a better post-audit at the State level;

—A clearer understanding of the real purposes of the substate regional districts, especially as they relate to the State agency, Federal-State program, and local governmental activities;

—State legislation along the lines of the ACIR's draft bill to check the growing power of special districts;

—A combined State and local drive to force the Federal administrators to ponder the consequences of continuing proliferation of separate unifunctional areawide bodies;

—An ending of the ambivalence in the minds of many local officials and citizens regarding the role of metropolitan and multicounty bodies (this ambivalence, after all, has helped to create the vacuum at the areawide level which the program specialists now are filling); and

—Finally, a deeper understanding within the electorate as a whole that failure to arm elected officials with adequate formal authority only strengthens the power of the "new feudalists"; and we are fast reaching the point where this understanding must be extended to the substate regional level, since—with the exception of a handful of metropolitan areas—there are at this level neither elected officials with any areawide authority nor an electorate empowered to interact with such officials by the ballot box or by any other means.

These are all means of righting the imbalance between the political decision makers and the program administrators, between electoral politics and program politics, between balanced and accountable decision making and skewed, fragmented decision making. These remorms are necessary if policy makers at all levels—the President and the Congress, the governor and the legislature, the mayor and the council—are to be strengthened in a fashion that will permit them to withstand the mounting, parochial presures that swirl around them. Top policy makers at all levels must be empowered to plan, pass, implement, and fund the vital programs that this and future generations of Americans require. If we fail to correct this imbalance in the system, then popular alienation and cynicism regarding our government can only grow.

VII.5 The cooperative approach to environmental enhancement

Joseph F. Zimmerman *

Interlocal service agreements have been utilized for many years, with federal encouragement, to solve areawide environmental problems. The emphasis the federal government places upon such agreements is reflected in the Federal Water Pollution Control Act Amendments of 1972 which direct the Governor of each State to identify areas suffering from water quality control problems and designate "a single representative organization, including elected officials from local governments or their designees, capable of developing effective areawide waste treatment management plans for [each area].[2]

The number of service agreements has increased sharply during the past twenty-five years following the removal of many constitutional and statutory restrictions inhibiting the ability of local governments to enter into such agreements. Currently, forty-two states have enacted a general interlocal contracting act. In twenty-nine states local governments are authorized to cooperate with local governments in other states, and Michigan authorizes its local governments to cooperate with Canadian local governments (see Table 1).

One of the broadest grants of power to local governments to cooperate with other governmental units is found in the New York State Constitution.

> Local governments shall have the power to agree, as authorized by act of the Legislature, with the federal government, a state or one or more other governments within or without the state, to provide cooperatively, jointly, or by contract any facilities, service, activity, or undertaking which each participating local government has the power to provide separately.[3]

Most states have granted blanket authorization to their local units to provide services to other units or jointly provide services, yet a number of states still have specific statutory provisions authorizing such agreements. Minnesota, for example, has approximately 110.[4]

Two provisions in many general interlocal cooperation acts impede the ability of local governments to enter into service agreements. A power may not be exercised in thirty-two states unless each local government possesses the power. This means that a city and a town can not jointly provide a service if only the city possesses the authority to provide the service. The general interlocal cooperation statute in thirteen states, further restricts the ability of local governments to enter into agreements by stipulating that an individual statute authorizing cooperation in a specific functional area is not superseded by the general statute. There are approximately two hundred specific statutes in New Jersey.[5]

The State of Rhode Island and Providence Plantations lack a joint exercise of powers act, but do have a general law specifically authorizing cities and towns to establish regional councils of governments. The law contains an unusual provision: A "council may, by appropriate action of the governing bodies of the member governments, exercise such other powers as are exercised or capable of exercise by the member governments and necessary or desirable for dealing with problems of mutual concern."[6]

One of the major reasons accounting

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	Code refer.	Coop. power	Contract power	Across State lines	Local unit w/home State	Local unit with U.S.	Power of only one unit sec.	Requires action of governing bodies	Approval of Attorney General	Other statutes unaffected	Revocation or term.	Responsibility clause
United States												
Alabama												
Alaska	C.X. Sec. 13	X			X	X	X					
Arizona	Sec. 11-951	X	X	X	X	X		X	X	X	X	X
Arkansas	Sec. 14-901	X	X	X	X	X		X	X		X	X
California	Gov. 6500	X	X2	X	X	X		X	X		X4	
Colorado	88-2-1	X	X	X	X	X		X		X		X
Connecticut	Sec. 7-339a	X	X	X	X			X	X	X		X
Delaware												
Dist. of Col.												
Florida	Sec. 163.01	X	X	X	X	X			X	X	X4	X
Georgia	Sec. 2-5901	X			X			X				
Hawaii												
Idaho	67-2319	X	X	X	X	X		X	X		X	
Illinois	24 Sec. 1-1-5	X	X	X	X	X						
Indiana	Sec. 53-1104	X	X	X	X	X		X	X			
Iowa	Sec. 28E.1	X	X	X	X	X	X3	X		X	X	X
Kansas	12-2901	X		X	X	X	X	X	X		X	X
Kentucky	65-210	X	X	X	X	X		X	X		X	X
Louisiana	33 Sec. 1321	X						X				
Maine	30 Sec. 1951	X			X	X	X	X	X		X	X
Maryland												
Massachusetts	Ch. 40 Sec. 4a	X	X					X			X	
Michigan	5.4088	X	X	X	X	X				X	X4	
Minnesota	Sec. 471.59	X	X	X	X	X		X		X	X	
Mississippi												
Missouri	Sec. 70.210	X	X	X	X			X			X4	
Montana	16-4904	X	X		X		X	X	X		X	
Nebraska	Sec. 23-2201	X	X	X	X	X		X			X	X
Nevada	277.080	X	X	X	X	X	X3	X	X		X	X
New Hampshire												
New Jersey	40.488-1	X						X		X	X	

New Mexico	4-22-1	X		X	X	X		X			X4	
New York		X		X								
North Carolina	Sec. 180A-460	X	X	X			X	X				
North Dakota	54-40-01	X		X		X	X	X		X	X4	
Ohio												
Oklahoma	74 Sec. 1001	X	X	X	X	X	X	X	X		X	X
Oregon	Sec. 190.003	X	X	X	X	X					X	
Pennsylvania	53 Sec. 471	X	X					X				
Rhode Island												
South Carolina	Sec. 1-75	X						X				
South Dakota	1-24-1	X	X	X	X	X		X				X
Tennessee	12-801	X	X	X	X	X		X	X	X	X	X
Texas	Art. 4413(32c)	X	X		X				X			
Utah	Sec. 11-13-1	X	X	X	X	X		X	X		X	X
Vermont	24 Sec. 34901	X	X					X	X			
Virginia	Sec. 15.1-21	X						X			X	X
Washington	39.34.010	X	X	X	X	X		X		X	X	X
West Virginia	Sec. 8-23-3	X	X					X	X	X	X	X
Wisconsin	66.30	X	X	X	X				X			
Wyoming	Ch. 239 S.L. 1971	X		X	X	X	X	X			X4	
Puerto Rico												

[1] The functions are limited—seems to include everything but general government.

[2] Cities and counties only.

[3] Only for contracting.

[4] May be provided for, but is not mandated.

[5] May be perpetual.

[6] One year renewable—if more, it must be approved by concurrent voter majorities.

[7] Binding for the specified time.

[8] Requires concurrent voter majorities.

[9] Requires approval of governor when State money is used. When State, U.S., another State or subdivision, Canada or subdivision are a party to the agreement.

Source: Advisory Commission on Intergovernmental Relations.

for the popularity of intergovernmental service agreements is their high degree of political feasibility. They usually encounter little opposition since they do not restrict significantly the freedom of action of the recipient governments, do not require voter approval in most cases, and usually can be terminated on relatively short notice. Consequently, local officials view service agreements as a flexible method of obtaining services as needed.

Three other reasons also account for the popularity of service agreements. First, a local government by means of an agreement, may be able to obtain a product or a service, such as water or sewage disposal, which the locality can not produce itself. Second, obtaining a service from another governmental unit may lower the cost and improve the quality of the service. The provider of the product or service also may benefit from a service agreement if it results in economies of scale. Third, interlocal agreements may facilitate the solution of a problem transcending local political boundaries without necessitating a major structural change in the local government system.

A local government, of course, may not have the option of producing a service or obtaining a service from another producer for one or more of the following reasons. First, a city or a public authority may have monopolistic control of a basic resource such as water, and all local governments must obtain water from this one supplier. Second, the cost of directly providing a service may be prohibitive. Third, the isolated location of a unit may preclude the possibility of obtaining a service from another unit. Fourth, the only neighboring local government with the ability to provide a given service may refuse to do so.

Service agreements, with a few exceptions, are entered into voluntarily by local governments. A state government on rare occasions has ordered one local government to provide a product or a service to a neighboring unit. And in a few states, Texas is an example, counties are required by statute to provide certain specified services upon receipt of a request from a city.

Data for this paper on the scope and nature of agreements for seventy-six services were obtained by means of a twenty page questionnaire sent to 5,900 incorporated municipalities—cities, villages, boroughs, incorporated towns—over 2,500 population. Returns were received from forty percent of these units, and were classified by population categories, geographic region, form of government, and central city, suburban and non-metropolitan types.

The collection of data on service agreements by means of a mail questionnaire, particularly a long one, results in an under-reporting of the number of agreements for two principal reasons.[7]

First, accurate records of service agreements, especially unwritten ones, are not maintained by most local governments. Second, several respondents indicated they did not have time to complete the questionnaire and returned it blank. It is reasonable to assume that some of these municipalities, as well as some which did not return the questionnaire, are parties to service agreements.

Services received

Table 2 reveals that sixty-three percent of the 2,375 responding municipalities have entered into formal and informal agreements for the provision of services to their citizens by other governmental units or private firms. The propensity to enter into agreements generally is related to population size. Units in the 50,000 to 100,000 population class, however, enter into agreements with a slightly greater degree of frequency than larger units, and units in the 25,000 to 50,000 class enter into agreements more often than units in the 100,000 to 250,000 class.

The presence of a larger number of acute problems and service suppliers in metropolitan areas accounts for the finding that central cities (seventy-five percent) and suburban governments (seventy-one percent) enter into service agreements with more frequency than municipalities in non-metropolitan areas (fifty-three percent).

Classifying service agreements by region, we find that they are most common in the West (seventy-nine percent) and least common in the South (fifty-four percent). Although agreements with a local government in a neghboring state were reported by only fourteen respondents, we know that such agreements are more common. To cite only two examples, sixteen Rhode Island cities and towns have joined with Attleboro and Seekonk, Massachusetts in a police communication network, and cities and towns in New Hampshire, Massachusetts, and Vermont are members of the Southwestern New Hampshire District Fire Mutual Aid System.[8]

Of the various forms of municipal administration, council-manager governments enter into service agreements with the greatest degree of frequency (sixty-nine percent). Vincent L. Marando reported a similar finding in the Detroit area in 1968.[9]

The finding of the national and Marando surveys is not surprising as a professional administrator is more likely than an elected chief executive to seek to lower the cost of a service or a product by obtaining it from other governmental units or private firms.

Municipalities most commonly enter into service agreements with counties and other municipalities. Nevertheless, the state government, public authorities, and private firms are major suppliers of service to local governments. Police training, criminal identification, police patrol, fireman training, traffic control, and water pollution abatement services are the principal services provided by state governments. Private firms are major providers of the following services—refuse collection, engineering, legal, street lighting, public relations, and microfilm.

The most popular agreements involve jails and detention homes, police training, street lighting, refuse collection, solid waste disposal, and animal control services.

Data relative to sewage disposal agreements are contained in Table 3. The bulk of the agreements, fifty-three percent, are with other local governments. Special districts also are parties to a significant number (eighty-seven) of agreements. Agreements with other local governments are most common in the South (sixty-nine percent) and least common in the Northeast (thirty-six percent), and council-manager and mayor-council units have about the same proclivity for entering into agreements. As one would anticipate, it is the smaller and medium size units which are parties to the agreements for the disposal of sewage with a greater degree of frequency than central cities which are more likely to have their own disposal facilities.

Table 4 reveals that solid waste disposal is most often provided under a service agreement by other local governments (forty-eight percent) and private firms (forty-two percent). The tendency of a local government to enter into an agreement with another local government for the disposal of solid waste is positively correlated with increasing population size with the exception of the 5,000 to 10,000 population category. The breakdown of agreements by geographic region is revealing. Whereas sixty percent of the responding incorporated municipalities in the North Central Region have entered into agreements with private firms, only thirty-one percent have entered into agreements with other local governments. By comparison, seventy-three percent of the responding municipalities in the South have entered into agreements with other local governments, but only sixteen percent have entered into agreements with private firms. Relative to form of government, fifty-one percent of the council manager units and forty-three percent of the mayor-council units have entered into agreements with other local governments for the disposal of solid waste.

The major suppliers of water, ac-

TABLE 2.—*Municipalities with agreements for receipt of services.*

	Number of reporting cities	Have agreement for service		With munici-palities		With counties		With school districts		With other special districts		With public authori-ties		With state		With other	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
TOTAL, ALL CITIES	2375	1491	63	600	40	919	62	380	25	412	28	249	17	429	29	217	15
POPULATION GROUP																	
Over 500,000	10	8	80	1	13	3	38	1	13	2	25	0	0	1	13	3	38
250,000-500,000	10	8	80	3	38	7	88	6	75	7	88	5	63	7	88	6	75
100,000-250,000	50	36	72	18	50	27	75	15	42	18	50	14	39	22	61	12	33
50,000-100,000	110	89	81	42	47	67	73	36	41	35	39	31	35	39	44	21	24
25,000- 50,000	236	180	76	81	45	118	66	60	33	60	33	46	46	64	36	31	17
10,000- 25,000	532	357	67	156	44	225	63	114	32	106	30	51	14	93	26	41	11
5,000- 10,000	618	360	58	141	39	217	60	77	21	86	24	52	14	98	27	41	11
2,500- 5,000	812	446	55	154	35	251	56	69	15	96	22	49	11	104	23	62	14
GEOGRAPHIC REGION																	
Northeast	502	275	55	149	54	83	30	72	26	55	20	67	24	79	29	37	13
North Central	791	513	65	224	44	317	62	126	25	142	28	58	11	122	24	73	14
South	706	380	54	118	31	253	67	66	17	81	21	81	21	123	32	66	17
West	398	313	79	109	35	266	86	116	37	134	43	43	14	105	34	41	13
FORM OF GOVERNMENT																	
Mayor-Council	1148	645	56	257	40	357	55	136	21	152	24	91	14	167	26	88	14
Council-Manager	1098	762	69	315	41	519	68	249	33	238	31	157	21	233	31	118	15
Commission	78	46	59	11	24	34	74	8	17	9	20	5	11	16	35	4	9
Town Meeting	57	30	53	12	40	6	20	15	50	9	30	6	20	11	37	4	13
Representative Town Meeting	14	8	59	5	63	3	38	2	25	2	25	1	13	2	25	2	25
LOCATION																	
Central City	155	117	75	43	37	81	69	41	35	46	39	37	32	53	45	39	33
Suburban Unit	1076	762	71	426	56	458	60	201	26	241	29	142	19	201	26	112	13
Non-Metropolitan Unit	1164	612	53	131	21	380	62	128	21	127	21	70	11	176	29	76	12

TABLE 3.—*Sewage disposal agreements.*

	Number of units reporting	With local governments		With school districts		With other special districts		With COG or other regional units		With state government		With Federal government		With private firms	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
TOTAL, ALL MUNICIPALITIES	307	165	53	1	0	87	28	23	7	5	1	5	1	18	5
POPULATION GROUP															
OVER 500,000	3	0	0	0	0	2	66	0	0	0	0	0	0	1	33
250,000-500,000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100,000-250,000	10	5	50	0	0	4	40	1	10	0	0	0	0	0	0
50,000-100,000	26	13	50	0	0	9	34	1	3	0	0	0	0	2	7
25,000- 50,000	48	28	58	1	2	12	2	5	10	0	0	1	2	1	2
10,000- 25,000	81	41	50	0	0	29	35	5	6	1	1	2	2	3	3
5,000- 10,000	67	41	61	0	0	15	22	6	8	2	2	0	0	3	4
2,500- 5,000	71	37	52	0	0	16	22	5	7	2	2	2	2	8	11
GEOGRAPHIC REGION															
Northeast	68	25	36	0	0	26	38	8	11	2	2	0	0	1	10
North Central	95	54	56	1	1	25	26	6	6	2	2	1	1	5	5
South	65	45	69	0	0	11	16	3	4	1	1	2	3	3	4
West	79	41	51	0	0	25	31	6	7	0	0	2	2	3	3
FORM OF GOVERNMENT															
Mayor-Council	115	61	53	1	0	26	22	11	9	1	0	4	3	10	8
Council-Manager	181	102	56	0	0	58	32	11	6	2	1	1	0	6	3
Commission	3	0	0	0	0	1	33	1	33	0	0	0	0	0	0
Town Meeting	7	1	14	0	0	2	28	0	0	2	28	0	0	2	28
Representative Town Meeting	1	1	100	0	0	0	0	0	0	0	0	0	0	0	0
LOCATION															
Central City	20	7	35	0	0	8	40	1	5	0	0	0	0	2	10
Suburban Unit	247	139	56	1	0	70	28	21	8	2	0	3	1	10	4
Non-Metropolitan Unit	40	19	47	0	0	9	22	1	2	3	7	2	5	6	15

TABLE 4.—*Solid waste disposal agreements.*

	Number of units reporting	With local governments		With school districts		With other special districts		With COG or other regional units		With state government		With Federal government		With private firms	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
TOTAL, ALL MUNICIPALITIES	301	146	48	0	0	14	4	8	8	4	1	0	0	128	42
POPULATION GROUP															
OVER 500,000	2	0	0	0	0	1	0	0	0	0	0	0	0	2	100
250,000-500,000	1	1	100	0	0	0	0	0	0	0	0	0	0	0	0
100,000-250,000	9	5	55	0	0	1	11	0	0	0	0	0	0	3	33
50,000-100,000	20	11	55	0	0	0	0	0	0	0	0	0	0	9	45
25,000- 50,000	42	20	47	0	0	4	9	1	2	1	2	0	0	16	38
10,000- 25,000	71	33	46	0	0	5	7	1	1	0	0	0	0	32	45
5,000- 10,000	64	36	56	0	0	1	1	2	3	2	3	0	0	23	35
2,500- 5,000	92	40	43	0	0	3	3	4	4	1	1	0	0	43	48
GEOGRAPHIC REGION															
Northeast	48	22	45	0	0	2	4	0	0	1	2	0	0	23	47
North Central	108	34	31	0	0	4	3	4	3	0	0	0	0	65	60
South	79	48	73	0	0	3	3	2	2	3	3	0	0	13	16
West	66	32	48	0	0	5	7	2	3	0	0	0	0	27	40
FORM OF GOVERNMENT															
Mayor-Council	126	55	43	0	0	5	3	6	4	3	2	0	0	56	44
Council-Manager	170	88	51	0	0	8	4	2	1	1	0	0	0	71	41
Commission	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Town Meeting	5	3	60	0	0	1	20	0	0	0	0	0	0	1	20
Representative Town Meeting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LOCATION															
Central City	29	15	51	0	0	1	3	0	0	0	0	0	0	13	44
Suburban Unit	175	73	41	0	0	13	7	6	3	1	0	0	0	81	46
Non-Metropolitan Unit	97	58	59	0	0	0	0	2	2	3	3	0	0	34	35

cording to Table 5, are other local governments (forty-five percent), private firms (twenty-five percent), and special districts (twenty-one percent). In general, water supply agreements are inversely correlated with population size; the exception being the 10,000 to 25,000 population class. Special districts (thirty-seven percent) are the major suppliers of water in the West and other local governments (sixty-seven percent) are the major suppliers in the North Central Region. Not surprisingly, incorporated municipalities in non-metropolitan areas receive water more often from private firms than from other local governments since there are few municipalities in such areas with the capacity of supplying water to other units.

Water distribution agreements present a somewhat different pattern than water supply agreements (see Table 6) in that incorporated municipalities have a greater tendency to enter into distribution agreements with private firms (thirty-eight percent) than with other local governments (thirty-five percent), and mayor-council units (thirty-two percent) have a lesser tendency than council-manager units (forty-one percent) to enter into agreements with private firms. The geographical pattern of the two types of agreements is generally similar, but suburban units are more dependent upon agreements for the supply of water than for the distribution of water.

Package of services

Relatively few agreements involve a package of services (see Table 7). The bulk of the agreements involve only one service and only two governments—the provider and the recipient of the services. Most binary agreements relate to functions which tend to be non-controversial—civil defense, fire and police mutual aid, jails, and water supply. We must point out, however, that many municipalities have entered into several individual service agreements.

There is a two-fold explanation for the small number of package agreements. First, few local governments have the ability and the desire to provide a package of services. Second, most recipients of services are interested only in a service which they can not provide economically themselves or a product which they can not produce themselves.

Not surprisingly, local governments in non-metropolitan areas are the recipients of the fewest packages of services. In these areas there often is no local government with the capacity to provide a package of services to other units.

The number of package agreements declines with a decrease in population with one exception—the 2,500 to 5,000 population class. Package agreements are most common in the West which is the home of the Lakewood Plan.

Many municipalities had received more than one service from another local government on a contract basis prior to 1954, yet the concept of a contract providing for a large number of services did not originate until 1954 when the newly incorporated City of Lakewood signed a formal agreement with Los Angeles County to have it provide all municipal type services to the citizens of the City.[10] Since 1954, all thirty-two cities incorporated in the County have contracted with the County for a package of services. Most agreements are for a five year term.

A typical service package includes animal regulation, election services, emergency ambulance services, enforcement of city health ordinances, engineering services, fire and police protection, library, planning and zoning, street construction and maintenance, and street lighting, certain services, such as animal regulations, are financed by fees.

Other services—fire protection, library, sewer maintenance, street lighting—are financed by means of special districts administered by the County. All other services are financed by direct reimbursement of county costs by the recipient cities.

Currently, seventy-seven cities in the County are parties to contracts with the County for the receipt of services. All

TABLE 5.—*Water supply agreements.*

	Number of units reporting	With local govern-ments		With school districts		With other special districts		With COG or other regional units		With state govern-ment		With Federal govern-ment		With private firms	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
TOTAL, ALL MUNICIPALITIES	297	135	45	1	0	65	21	7	2	7	2	5	1	11	25
POPULATION GROUP															
OVER 500,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250,000-500,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100,000-250,000	11	3	27	0	0	5	45	0	0	0	0	7	9	2	18
50,000-100,000	26	9	34	0	0	9	34	1	3	1	3	1	3	5	19
25,000- 50,000	38	16	42	1	2	10	26	1	2	0	0	2	5	8	21
10,000- 25,000	76	38	50	0	0	13	17	0	0	0	0	0	0	25	32
5,000- 10,000	71	32	45	0	0	14	19	4	5	2	1	1	1	18	25
2,500- 5,000	75	37	49	0	0	14	18	1	1	4	5	0	0	19	25
GEOGRAPHIC REGION															
Northeast	64	20	31	0	0	13	20	3	4	0	0	0	0	28	43
North Central	98	66	67	1	1	8	8	0	0	2	2	1	1	20	20
South	76	37	48	0	0	22	28	1	1	2	2	3	3	11	14
West	59	12	20	0	0	22	37	3	5	3	5	1	1	18	30
FORM OF GOVERNMENT															
Mayor-Council	129	63	48	1	0	19	14	3	2	5	3	1	4	37	28
Council-Manager	156	67	42	0	0	44	28	4	2	2	1	4	2	35	22
Commission	6	3	50	0	0	1	16	0	0	0	0	0	0	2	33
Town Meeting	4	1	25	0	0	1	25	0	0	0	0	0	0	2	50
Representative Town Meeting	2	1	50	0	0	0	0	0	0	0	0	0	0	1	50
LOCATION															
Central City	19	8	42	0	0	7	36	1	5	0	0	0	0	3	15
Suburban Unit	218	110	50	1	0	45	20	5	2	4	1	4	1	49	22
Non-Metropolitan Unit	60	17	28	0	0	13	21	1	1	3	5	1	1	25	41

TABLE 6.—*Water distribution agreements.*

	Number of units reporting	With local governments		With school districts		With other special districts		With COG or other regional units		With state government		With Federal government		With private firms	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
TOTAL, ALL MUNICIPALITIES	163	58	35	1	0	33	20	5	3	1	0	3	1	62	38
POPULATION GROUP															
OVER 500,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250,000-500,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100,000-250,000	6	3	50	0	0	2	33	0	0	0	0	0	0	1	16
50,000-100,000	10	2	20	0	0	3	30	0	0	0	0	0	0	5	50
25,000- 50,000	18	5	27	1	5	5	27	0	0	0	0	1	5	6	33
10,000- 25,000	36	12	33	0	0	4	11	0	0	0	0	0	0	20	55
5,000- 10,000	42	16	38	0	0	7	16	2	4	0	0	1	2	16	38
2,500- 5,000	51	20	39	0	0	12	23	3	5	1	1	1	1	14	27
GEOGRAPHIC REGION															
Northeast	38	8	21	0	0	8	21	1	2	0	0	0	0	21	55
North Central	EJ	26	52	1	2	4	8	0	0	0	0	1	2	18	36
South	39	20	51	0	0	10	25	2	5	0	0	2	5	5	12
West	36	4	11	0	0	11	30	2	5	1	2	0	0	18	50
FORM OF GOVERNMENT															
Mayor-Council	78	32	41	1	1	13	16	4	5	1	1	2	2	25	32
Council-Manager	77	25	32	0	0	19	24	1	1	0	0	0	0	32	41
Commission	2	0	0	0	0	0	0	0	0	0	0	1	50	1	50
Town Meeting	4	0	0	0	0	1	25	0	0	0	0	0	0	3	75
Representative Town Meeting	2	1	50	0	0	0	0	0	0	0	0	0	0	1	50
LOCATION															
Central City	11	5	45	0	0	3	27	0	0	0	0	0	0	3	27
Suburban Unit	112	40	35	1	0	25	22	2	1	1	0	2	1	41	36
Non-Metropolitan Unit	4J	13	32	0	0	5	12	3	7	0	0	1	2	18	45

TABLE 7.—*Municipalities receiving and providing a package of Services*

	Number of municipalities reporting	Receive package of services #	%	Number of municipalities reporting	Provide package of services to other units #	%
TOTAL, ALL MUNICIPALITIES	1394	188	13	2135	239	11
POPULATION GROUP						
Over 500,000	4	1	25	6	3	50
250,000-500,000	8	2	25	10	4	40
100,000-250,000	31	8	26	43	8	19
50,000-100,000	82	18	22	97	24	25
25,000- 50,000	167	32	19	216	31	14
10,000- 25,000	341	46	13	482	61	13
5,000- 10,000	338	31	9	542	59	11
2,500- 5,000	418	49	12	726	47	6
Under 2,500	5	1	20	13	2	15
GEOGRAPHIC REGION						
Northeast	256	34	13	451	55	12
North Central	492	52	11	699	86	12
South	352	44	13	619	56	9
West	294	58	20	366	42	11
FORM OF GOVERNMENT						
Mayor-Council	599	61	10	997	86	9
Council-Manager	721	114	16	1014	145	14
Commission	40	10	25	64	6	9
Town Meeting	27	2	7	47	1	2
Representative Town Meeting	7	1	14	13	1	8
LOCATION						
Central City	100	22	22	133	31	23
Suburban Unit	724	116	16	977	111	11
Non-Metropolitan Unit	570	50	9	1025	97	9

TABLE 8.—*Reasons why municipalities use intergovernmental agreements.*[1]

Total Munici-palities Reporting	Take advantage of econo-mies of scale (1)		Lack of facilities (2)		Lack of qualified personnel (3)		Meet an urgent problem (4)		Citizen demand for service agreement (5)		Take service out of politics (6)		Civil service avoid-ance (7)		Other (specify) (8)	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
AP 112	74	66	44	39	28	25	8	7	1	1	1	1	0	—	12	11
NP 46	16	35	22	48	5	11	5	11	1	2	—	—	—	—	5	11
WP 111	37	33	37	33	15	14	12	11	—	—	—	—	1	1	9	8
RC 329	168	51	123	37	16	5	31	9	7	2	5	2	9	3	12	4
SD 306	164	54	93	30	13	4	40	13	3	1	2	1	0	—	18	6
SL 105	55	52	28	27	11	10	16	15	1	1	1	1	—	—	10	10
SW 283	155	55	101	36	11	4	35	12	—	—	1	—	1	—	8	3
WS 278	126	45	119	43	8	3	36	13	8	3	0	1	2	1	21	8
WD 126	51	40	43	34	5	4	11	9	2	2	5	4	—	—	18	14

[1] Percentages, when totaled, may exceed 100% since many respondents noted more than one reason. [2] Less than 1 per cent.

AP—Air pollution	SL—Sewer lines
NP—Noise pollution	SW—Solid waste disposal
WP—Water pollution	WS—Water supply
RC—Refuse collection	WD—Water distribution
SD—Sewage disposal	

seventy-seven cities receive election services under contracts, and all cities except Vernon contract with the County for state health law enforcement. And all cities but Santa Monica have contracted for the maintenance of city prisoners in the County Jail.

Reasons and negotiation

Each recipient of the survey questionnaire was requested to "check the reason that best explains your decision to use an intergovernmental service agreement for the provision of the service." Eight reasons were listed—(1) take advantage of economies of scale, (2) lack of facilities, (3) lack of qualified personnel, (4) meet an urgent problem, (5) citizen demand for service agreement, (6) take the service out of politics, (7) civil service avoidance, and (8) other. As Table 8 reveals, the principal reason for entering into agreements for the receipt of environmental services is to take advantage of economies of scale. The reasons, of course, vary according to the service involved. Lack of facilities, for example, is a more important reason for entering into a noise pollution abatement agreement than economies of scale.

Agreements in thirty-six percent of the reporting municipalities are negotiated by the mayor and council. The manager or administrator negotiates the agreements in thirty-four percent of the units, and the manager and council negotiate the agreements in twenty-six percent of the units.

The mayor and council most commonly negotiate the agreements in cities over 250,000 population whereas the manager or administrator most commonly negotiates the agreements in cities in the 25,000 to 100,000 population category. This finding is in general accordance with the prevalence of these two forms of administration in municipalities in these two forms of administration in municipalities in these population categories.

Evaluation of agreements

In fifty-six percent of the reporting municipalities the performance of the supplier of services is evaluated by performance measures established in the agreements. Sixty-five percent of the central cities, however, evaluate the services by means of periodic inspection by their personnel. This method also is used by fifty-two percent of the suburban communities and forty percent of the non-metropolitan communities. Levels of citizen satisfaction, as measured by the number of citizen complaints, are used by sixty-one percent of the central cities, fifty-eight percent of the suburban communities, and forty-eight percent of the non-metropolitan communities to evaluate the performance of the suppliers of services.

The vast majority of the recipients of services are satisfied with the service agreements as only 137, or six percent, of the 2,367 responding local governments have terminated agreements. Central cities (twelve percent) discontinued agreements with greater frequency than suburban municipalities (five percent) or municipalities in non-metropolitan areas (three percent). The small percentage of agreements terminated in the latter type of municipalities undoubtedly is due to the fact that these units have few if any alternative methods of providing or obtaining the services.

Joint agreements

Agreements for the joint provision of services and the joint construction and operation of facilities are relatively common. Union agreements differ from standard service agreements in that two or more governmental units join forces to provide the service or construct the facility, a joint body usually is created to administer the program, and each participant typically is a coequal partner.

Thirty-five percent of the reporting municipalities are parties to agreements for the joint provision of services. Larger units generally enter into agreements most often—eighty percent of the units in the 250,000 to 500,000 population category and only twenty-seven percent of the units in the 2,500 to 5,000 category.

Conjoint service agreements are most common in the West (forty-nine percent) and least common in the South (twenty-eight percent). Forty-three percent of the council-manager municipalities participate in joint agreements compared to thirty-one percent of the commission cities and twenty-nine percent of the mayor-council cities. Not unexpectedly, central cities (sixty-two percent) enter into such agreements with greater frequency than suburban communities (thirty-nine percent), or non-metropolitan municipalities (thirty-one percent). In part, this finding is a reflection of the fact that the central city usually has more opportunities to enter into joint agreements, particularly with the county.

Twenty-one percent of the responding municipalities are parties to joint construction and joint leasing agreements. Once again, larger units have the greatest proclivity for for participating in such agreements—sixty percent of the units in the 250,000 to 500,000 population category compared to fourteen percent of the units in the 2,500 to 5,000 categories. Council-manager units are nearly twice as likely to be parties to these agreements as are mayor-council cities. And more central cities (forty percent) sign these agreements than suburban governments (twenty-two percent) or non-metropolitan municipalities (eighteen percent).

Agreements for the joint leasing of equipment are relatively uncommon. Only fifty-five municipalities report that they are signatories to such agreements. Agreements for the loan of personnel or equipment are more common with fifteen percent of the reporting units parties to agreements of this nature.

Services provided by counties

In 1971, the Advisory Commission on Intergovernmental Relations, International City Management Association, and National Association of Counties cooperatively surveyed 3,047 county governments relative to services provided for individual local governments within each county on a contract basis, provided on a joint basis with local governments in each county, and jointly provided or under contract with another county.

As Table 9 reveals, one-third of the 848 reporting counties provide services on a contract basis to local governments within the county. Although seventy-three percent of the reporting counties with a population over 500,000 provide contract services, these counties account for only 5.7 percent of the total number of service agreements. Interestingly, slightly more than one-quarter of the reporting counties providing services are in the 10,000 to 25,000 population class. This finding in part is a reflection of the greater number (998) of counties in this population class.

More than one third of the responding counties provide services jointly with other local governments. As in the case of the contract services, joint service agreements are most common among counties in the 10,000 to 25,000 population class. This finding in part is a reflection of the greater number (998) of counties in this population class.

Joint agreements with another county for the provision of services are relatively prevalent—226 out of 744 reporting counties have such agreements. These agreements also are most common in the 10,000 to 25,000 population class and in non-metropolitan areas.

Inhibiting factors

"Limitations placed on independence of action by the agreement" was checked by nearly one-half of the reporting incorporated municipalities as the factor which has the most adverse effect on their willingness to enter into an agreement with another governmental unit to obtain services.

"Inequitable apportionment of the cost of the service" inhibited nearly one-fourth of the municipalities from entering into agreements. The only other factor checked by a significant number of officials (nine percent) was "adverse public reaction to services presently

TABLE 9.—*Counties supplying services on a contract basis 1971.*

Population group	Number of counties	Number of responding counties	Provide services #	Provide services %	Do not provide services #	Do not provide services %
Over 500,000	58	22	16	5.7	6	1.1
250,000-500,000	70	39	16	5.7	13	2.3
100,000-250,000	185	62	32	11.0	30	5.5
50,000-100,000	326	94	40	14.2	54	9.0
25,000- 50,000	566	153	48	17.1	105	18.8
10,000- 25,000	998	258	73	26.0	185	32.6
Under 10,000	844	230	56	19.9	174	30.7
Total	3,047	848	281	100.0	567	100.0

Source: 1971 survey of county governments by the Advisory Commission on Intergovernmental Relations, International City Management Association, and National Association of Counties.

being provided by another unit." Responses did not vary much by region, form of government, and central city, suburban, or non-metropolitan type.

The New Jersey County and Municipal Government Study Commission found "great hope in the fact that the overwhelming majority of officials in over 400 municipalities polled and interviewed are willing and anxious to enter into joint service agreements on a wide variety of areas."[11] Our national survey did not produce such optimistic data—478, or twenty percent, of the 2,383 reporting incorporated municipalities are contemplating entering into agreements with other units for the provision of services.

State and federal encouragement

Only forty-four of the respondents felt that the state constitution prohibits their municipalities from entering into agreements for the receipt of services or inhibits their ability to enter into agreements. A larger number (109) report that state statutes impede their ability to enter into service agreements.

Three-fourths of the reporting municipalities indicate that the state government actively encourages the intergovernmental provision of services. Forty-eight percent report that the state provides incentive grants-in-aid, forty-two percent mentioned financial assistance for studies, and fifty-six percent report the state provides technical assistance.

Only twenty-eight local governments felt that federal statutes and regulations restricted their ability to enter into agreements for services with another governmental unit. One-half of the respondents replied affirmatively to the question "Do federal statutes and regulations encourage intergovernmental contracting and cooperation?"

Concluding comments

Incorporated municipalities over 2,500 population, according to our national survey, receive a significant number and a large variety of services from other governmental units and private firms under provisions of informal and formal agreements. More than three-fifths of the responding units receive services from other governmental units, yet most agreements are limited in scope and involve only a single service. This finding agrees with the finding of Vincent L. Marando that in the Detroit area "cooperative agreements entered into by a municipality were generally confined to one functional area. It did not appear that such agreements were generally confined to one functional area. It did not appear that such agreements were generally confined to one functional area. It did not appear that such agreements were encouraging municipalities to cooperate with one another on a large number of varied functions."[12]

Service agreements would play a larger role in solving major environmental problems if a plan for the multilateral use of agreements was developed and promoted in each region by a metropolitan planning commission, council of governments, or the state. The widespread and successful use of multi-lateral agreements, however, would have three undesirable consequences.

First, a large number of agreements would complicate an already complex local governmental system and make it less comprehensible to the average citizen. This, in turn, will make it more difficult for citizens to pinpoint responsibility for failures of the local governmental system.

A second undesirable consequence of a proliferation of service agreements would be the reinforcement and perpetuation of the existing fragmented governmental system in the typical metropolitan area. Services agreements may make more difficult the creation of an areawide government with adequate powers to solve the major problems of the metropolis.

A closely related consequence may be the promotion of additional political fractionation and fiscal disparities in a number of metropolitan areas. Even the Advisory Commission on Intergovernmental Relations, a strong supporter of interlocal contracting, recognized "that under certain conditions such contracts can only further fragment unnecessarily the metropolitan tax base. The presence of nonviable 'paper' communities, incorporated under highly permissive state legislation and sustained by interlocal contracting arrangements, undoubtedly creates extremes of fiscal capacity or incapacity within certain areas." [13]

The cooperative or ecumenical approach to the solution of service problems will continue to be popular with local government officials in the future because the approach allows units to take advantage of economies of scale and has a minimal disruptive impact on local governments. And it is not unreasonable to forecast that most state governments will expand their efforts to encourage local governments to enter into service provision agreements and in special cases to order one unit to provide a service to one or more contiguous units.

Service agreements probably will continue to act as a safety valve in reducing the pressures for the establishment of a metropolitan government. If cooperation, however, fails to solve the major problems of the metropolis, pressure will be generated for the preemption of responsibility for solving problems by the federal and state governments.

One must not lose sight of the facts that not all governmental service problems lend themselves to solution by means of service agreements, and that the potential of intergovernmental cooperation is limited principally to the solution of relatively minor and noncontroversial problems involving a small number of local governments.

We conclude by pointing out that increasing metropolitan scale and development of megalopolises limit severely the ability of interlocal cooperation to solve major areawide problems and will increase the pressure for the upward shift of responsibility for problem solving.

Notes for Paper 5

[1] This paper is based on data collected for a larger study of substate regionalism being conducted by the Advisory Commission on Intergovernmental Relations under the direction of Dr. Carl W. Stenberg. See Joseph F. Zimmerman, "Intergovernmental Service Agreements" in *Substate Regionalism* (Washington, D.C.: Advisory Commission on Intergovernmental Relations, forthcoming), chap. III.

[2] *Federal Water Pollution Control Act Amendments of 1972*, 70 STAT. 498, 33 U.S.C. 1151.

[3] *Constitution of the State of New York*, art. IX, sec. 1(c).

[4] Leigh E. Grosenick, *A Manual for Interlocal Cooperation in Minnesota* (St. Paul: Office of Local and Urban Affairs, State Planning Agency, May 1969), p. 113.

[5] *Joint Services—A Local Response to Areawide Problems* (Trenton: County and Municipal Government Study Commission), p. 38.

[6] *Rhode Island General Laws Annotated*, §§ 54-43-3.

[7] For a fuller description of the problems encountered in gathering data on service agreements, see H. Paul Friesema, *Metropolitan Political Structure: Intergovernmental Relations and Political Integration in the Quad Cities* (Iowa City: University of Iowa Press, 1971), pp. 37-42.

[8] Joseph F. Zimmerman, "Solving Areawide Problems in Rhode Island," *Newsletter* (Kingston: Bureau of Government Research, University of Rhode Island, September 1972), p. 2, and "Can Cities and Towns Meet the Challenges of the Space Age?" *New Hampshire City and Town*, June 1972, pp. 104-10.

[9] Vincent L. Marando, "Inter-Local Cooperation in a Metropolitan Area: Detroit," *Urban Affairs Quarterly*, December 1968, p. 193.

[10] See the *California Government Code*, § 51301 and *Los Angeles County Charter*, § 56½.

[11] *Joint Services: A Local Response to Areawide Problems* (Trenton: County and Municipal Government Study Commission, 1970), p. iv.

[12] Vincent L. Marando, "Inter-Local Cooperation in a Metropolitan Area: Detroit," p. 199.

[13] *Fiscal Balance in the American Federal System: Metropolitan Fiscal Disparities*. Vol. 2 (Washington, D.C.: Advisory Commission on Intergovernmental Relations, October 1967), p. 15.

VII.6

Managing at the local level

Mark E. Keane *

Environmental management is one of the most intriguing public issues. It has about it a spirit of hope which is otherwise in short supply today. There is a sense of being in on the beginning of a great battle on behalf of society.

There are ten points on the nature of environmental management and the need for a strong local government in the "New Federalism" that I feel are important and should be discussed. They are as follows:

Point 1. This conference is typical of the environmental movement in the *variety* of speakers you have heard. The academic community is well represented along with all levels of the government —Federal, state, county, metropolitan, and city. The private business sector has been represented too, although probably not in adequate strength commensurate with their importance. From the White House to the Courthouse we have looked at this strange creature known as the environment. And that is the only way we will make progress back in our home communities—by getting together like this.

Point 2. The environmental struggle needs constant attention from the media, not only when it stages a dramatic crisis or demonstration. The papers, radio, and TV need to be educated to the issues, the problems, and the potentials, even as we do.

Point 3. The dimension of race is a pervasive influence in all the problems of current American society. No matter how we may measure the quality of life in our nation or in our community, we need to establish a base point monitoring system on those who have been short circuited in the affluence of the rest of society.

Point 4. Politics determines the environment. We have faced the enemy of pollution: how can he be defeated? —by the *government*, or federal, state, and local working together. *They* will allow the citizen to express himself and *they* will heed the computers and the system analyses of their professional staffs and of the academic community. And who is they? It is the elected leaders, from the President of the United States to the trustee of the smallest village. We know by now that they are human and uncertain, and often tired and weak, even as we are. We do not generally understand, however, the tremendous stress and pressure of elective office today. We do not adequately analyze how the elected official may be helped and supported in making those decisions we may think are so right and so necessary. But they must and will make the decision, even if the decision is to do nothing.

Point 5. We adapt to the environment at the *local* level. It's so obvious— "you've made your bed, now lie in it." In the cities, the complex jargon and the sophisticated interrelationships of the ecosystems translate to plain sensory shocks: stinks, worms, rats, mud and flood, backed-up sewage, messy garbage, ugliness, noise, sickness, coughs, jams and delays, ad nauseum. This is the way *you* feel it, the way *I* feel it. These are insults to the *senses* that are largely controllable by *community action*, given the essential national foundation of basic law, commitment and resources.

Point 6. National strategy should aim at creating the climate for energizing local initiative. The results will be uneven, but there will always exist a basic need for diversity and freedom of choice. The goal is to achieve an ever-rising minimum standard, not some ideal equality and purity.

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*Presented by Mark E. Keane, Executive Director, International City Management Association, at the National Conference on Managing the Environment.

Point 7. At the local level, this point of most important action, *decisions* are difficult to come by. The *people* are there. They see, feel, touch, taste, and smell what their local officials *do* to them. City Hall and the Courthouse are within reach. No long distance toll charges are necessary. Decisions are less likely to be dramatic or revolutionary, less likely, in fact, to deal with *ego*-systems. They move incrementaly. Comprehensive plans are generally ignored, while a change in zoning on one single lot may fill the council chambers for a public hearing. So, do we surrender to destruction of the environment while constructive change moves at such a local pace? This may be. Or, we may evolve a science of political action that permits such involvement at the local level while reshaping the basic framework at regional, state, and federal levels.

Point 8. Political leadership at the local level needs to build, develop, and sustain the best talent available as staff, to help them understand and analyze the environmental issues. Not even a sign ordinance is simple; a water bill is potential dynamite; a garbage bag will break in your face. A local elected official needs the help of well trained, broad-gauged advisors, who will help evolve policies that will actually work to achieve the original objective. They need to be organized in new ways that integrate their viewpoints, ways that bring them out of their functional specialities, a climate of interrelationships that focuses their attention on the common problem and away from their particular departmental kingdoms.

Point 9. The technological capacity to deal with environmental issues cannot reach local governments today through the traditional channels. Field representatives of federal or state agencies and private consulting firms are helpful, of course, but in most cases they have a standard product to sell. New kinds of institutions will be created by local governments to serve their special needs. An example is Public Technology Incorporated, which has been organized by the national associations, such as ICMA, representing state and local government. PTI is designed to serve as the vehicle for facing the local governments' problems against the technology of the universities and of industry. The software and hardware products developed through this constant interface of producer and consumer will constitute an important part of the capacity of local government to meet environmental needs.

Point 10. We have postulated much about citizen involvement in the decision-making process. We have concluded that it is vital. We reach the same conclusion on every public issue. A public official welcomes public participation when it tends to support the ongoing process of government, but tends to wish it would go away when seemingly essential projects are stopped dead or when decisions seem forever delayed. You in public life at the front lines in local government know there is no formula, no pat solution. It is the essence of the local political process. However, there has been too little effort to help the politician bridge the gap of understanding between him and his voters. Those who hope to improve the effectiveness of citizen involvement need to develop a strategy in each community, one that best fits its political traditions. Frontal assault will be necessary in some, while in others city hall will gladly join with the citizens as a team if the method and the motivation is carefully and wisely developed.

The environment, perhaps more than any other issue, requires intergovernmental solutions. It is important therefore that an appropriate role for the federal, state and local levels be defined and adhere to. The direction of the "New Federalism," as exemplified in general revenue sharing and the proposed special revenue sharing, has rightly placed greater responsibility back in the local level. The local government official will make or break this great national effort. We need to continue this process of helping him, respecting him, and most importantly, listening to him.

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